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THE MASONRY ARCH BRIDGE ACROSS THE CONNECTICUT RIVER AT HARTFORD.

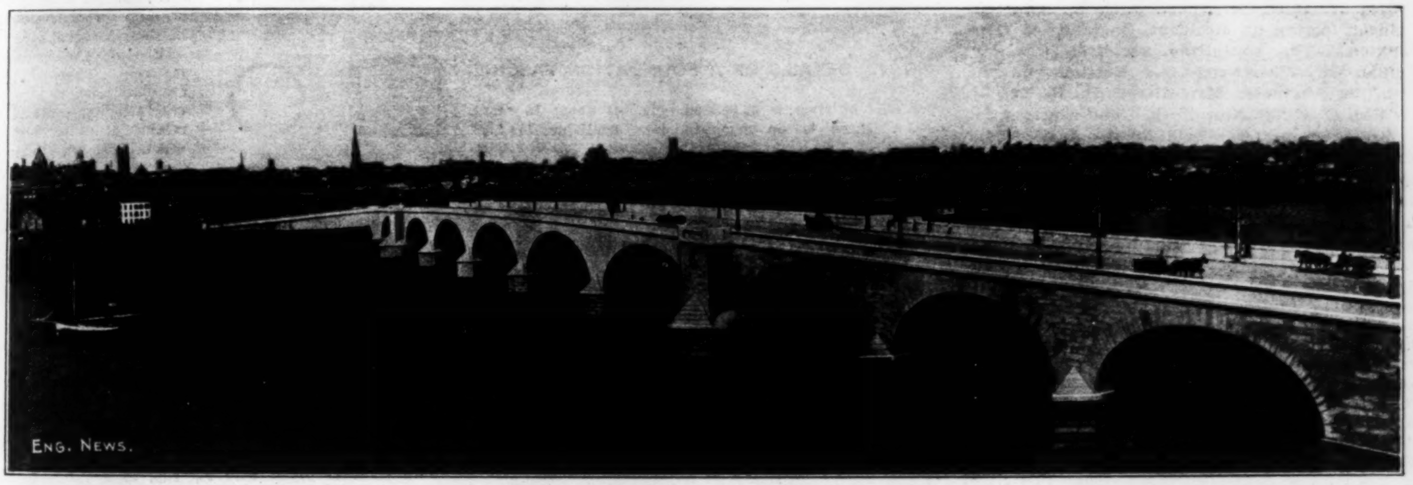
When considerations of cost become subordinate to those of beauty, the stone voussoir arch, if simply treated and free from excessive ornamentation so ruinous in bridge architecture, has a dignity and grace that concrete construction, even in its present highly developed state, cannot approach. But the pressing needs of economy and the structural efficiency of the concrete arch, especially when reinforced with steel, have together acted in the past decade almost entirely to remove the stone structure from that field of bridge construction where artistic necessities and the fear of heavy maintenance charges had already displaced the steel truss. The erection at this time and in this country of a monumental stone arch bridge is therefore a matter of considerable moment. On the accompanying cut we are able to show a view of one of the finest examples this side of the ocean of this style of bridge design; Hartford Bridge across the Connecticut River at Hartford, Conn., opened first for travel last December, but formally dedicated in a three-day celebration on Oct. 6, 7, 8, 1908.

Hartford Bridge has a total length of 1,192 ft. and a total width of 82 ft., comprising two 10-ft. sidewalks and a 60-ft. roadway, carrying a trolley line. It consists of nine semi-elliptical arches measuring, from west to east, 101.5, 108, 115, 119, 115, 108, 81, 74 and 68 ft., respectively, with the rise of each arch equal to one-quarter its span. The piers were all founded on solid bottom by the pneumatic caisson process, in some cases as deep as 50 ft. below low water. From top of footings to springing line the face stone is rough-face Leete's Island granite, but above the spring all face work is dressed Stony Creek granite, a reddish stone of fine texture. The cut and shaped stone is only carried back for one course, the backing being a heavy rubble concrete, but in all cases alternate stones are of different length so as to ensure an effective bond into the concrete. In the same manner the arch ribs (inside the face) are formed of alternate deep and shallow stones, the deepest of which do not quite equal the ring thickness, which is completed by concrete backing. The roadway is macadam carried on dirt fill and protected by massive granite railings.

In architectural treatment the bridge is especially dignified. There are no superfluous ornate cornices as pier details, merely the simple regular placing of stone on stone, with the monotony-relieving cut-waters at each pier. It is unfortunate that the electric railway is a trolley line across the bridge, but every effort has been made to make the trolley poles as unobtrusive as possible. They are of bronze, placed on each side of the road, and serve also as electric light poles. At the west end of the bridge, the tracks of a branch of the N. Y., N. H. & H. R. R. pass under the abutment and approach in a long tunnel, the portal to which, though some hundred feet south of the bridge, has been made of cut granite in style to conform with that of the bridge.

Quite as important as the details of the arches in the appearance of the bridge is the general arrangement of the approaches. On the Hartford side, the west bank of the river, the shore up to a few years ago had been given up to the dirtiest of commercial industries, railway yards, coal storages, and a very poor class of residences. Realizing the inconsistency of terminating so costly a bridge in such a neighborhood, the engineers, backed up by a popular vote, condemned the whole river front for a considerable distance on either side of the bridge and back from the shore, and in this space constructed a wide boulevard leading directly from the center of the city. This transformation of the river front from the usual squalid district to its proper place as a recreation ground for the people is one of the greatest improvements in the new construction. The other side of the river, in East Hartford, is still in a semi-rural state, so that as yet no changes have been started.

Not a little interest pertains to the history of the bridge. In 1809 the first bridge, a wooden structure, was built across the river at this point. This remained until 1818, when it was washed away by a freshet, but in the same year another timber bridge was built which remained in service until destroyed by fire in 1895. Up to 1889 toll was charged, but in that year the towns of Hartford, East Hartford, Glastonbury, Manchester and South Manchester, were banded into a "Bridge District," which purchased the bridge and turned it into a free structure. After the fire of 1895 a Bridge Commission was appointed by the Governor with power to erect a new bridge. First, a temporary steel bridge was built, and in 1903 work was commenced on the present masonry structure. Although much more expensive than a steel bridge, the cities overwhelmingly voted for the stone arches and in addition appropriated the extra funds necessary for the construction of the boulevard. The U. S. War Department at first required a draw across the channel, but by special act of Congress this feature was omitted. The cost of the masonry bridge was about $1,600,000, an excess of close to a million dollars over a steel bridge for the same span. This excess cannot be justified on the grounds of less expensive maintenance, but only on account of the more pleasing result. The expense was divided up according to accepted proportions among the five towns in the district, Hartford paying by



HARTFORD BRIDGE ACROSS THE CONNECTICUT RIVER.

(Total length, 1,192 ft.; 60-ft. roadway, two trolley tracks, two 10-ft. sidewalks; nine granite arches, backed with concrete, varying in span from 68 to 119 ft.)
(Photograph by Havens & Chudoba, Hartford, Conn.)

far the greatest amount. Besides this $1,600,000, the boulevard, in condemned land and improvements, cost about $1,400,000.

Any article on the bridge and its approaches would be incomplete without some reference to the exercises of the three days in October when the opening was celebrated. So ambitious a civic celebration in our knowledge has never before been occasioned by the completion of any engineering work. For three days the city of Hartford was given over to pageant, parade and ceremony. Throngs of visitors from the whole state crowded at all hours the decorated and illuminated streets. Immense grandstands were erected on the side of the new boulevard overlooking the bridge and the river, and from them many thousands reviewed the civic, masonic, military, automobile and naval parades and viewed the presentation in float and tableau of scenes from the city's history. The exercises terminated with the masonic laying of the last stone and the unveiling of the bronze tablet on the Hartford end of the bridge. Such an occasion is, of course, of very material benefit to the business men of a city, but even allowing for their influence in arranging the celebration, the recognition of a great municipal improvement in so unique a manner is worthy of commendation.

The Bridge Commission under whom the construction of the bridge was carried out was headed by U. S. Senator Morgan G. Bulkeley, to whom most of the credit for the successful administration of the project is due. The Chief Engineer of the Commission is Mr. Edwin D. Graves, M. Am. Soc. C. E., who prepared the plans for the bridge and supervised its construction up to about two years ago, when he was forced to retire from active duty on account of illness. Since then Mr. John G. Henderson, M. Am. Soc. C. E., has been Deputy Chief Engineer in charge of the work, with Mr. Edward W. Bush, M. Am. Soc. C. E., Assistant Engineer, acting as Resident Engineer of Construction. The consulting architect was Mr. Edmund M. Wheelwright, of Boston, and the consulting engineer, Mr. Alfred P. Boller, M. Am. Soc. C. E., of New York. The contract for the bridge proper was held by the firm of McMullen, Weand & McDermott, of New York. The approaches and the boulevard were let in numerous small contracts.

The photograph of the bridge shown herewith was taken by Havens & Chudoba, of Hartford, from whom copies of the original may be obtained.

REBUILDING IN CHELSEA, Mass., after the extensive fire of last April has been very active, says the Boston "Globe." Over 300 building permits have been issued, representing a value of two to two and a half million dollars. In June, after the city's affairs were put in charge of a Board of Control, fire limits were established and it was ordered that all buildings within this area must be of fireproof construction. This placed matters on a definite basis and rapid progress has been made since then.

RAPID SHIPBUILDING is being done on the "North Dakota," the new large-gun ship for the United States Navy, by the Fore River Ship & Engine Building Co., Quincy, Mass. The contract for this ship is dated Sept. 1, 1907, the keel was laid on Dec. 16, and it is expected that the launching will occur on Nov. 10 if present plans go through. The official report of the Bureau of Construction and Repair of the Navy Department gives the percentage of completion on Oct. 8 as 54.2%. The contract period is 34 months. No previous battleship building in American shipyards has attained such speed. If the launch takes place as planned, it will be the first occasion on this side of the water of a war vessel being launched in less than a year from the time the keel was laid or within 15 months from the date of the contract.

Other war vessels in construction have reached the following stages, according to the same official report: Battleships—"South Carolina," 63%; "Michigan," 71%; "Delaware," 44%.

Destroyers—Five destroyers, respectively 54%, 52%, 49%, 26% and 26%.

Submarines—Seven, ranging from 50% to 59%.

Other vessels—Two colliers, 96% and 83%; two tugboats, 79% and 95%.

THE DAVID NEALE SYSTEM OF RIVER IMPROVEMENT AND BANK PROTECTION.

By CHARLES H. MILLER,* M. Am. Soc. C. E.

There seems to be no difference of opinion regarding the fact that the first step towards the permanent improvement of the channel of a silt-bearing stream is in the direction of protecting the banks against further erosion, with its consequent addition of silt, and the deposition of a large part of the same at some point further down stream.

Mr. J. A. Ockerson, M. Am. Soc. C. E., in a paper "On Erosion of River Banks" (Vol. XXVIII. of the Trans., Am. Soc. C. E.,) states for the 885 miles of the Mississippi River from Cairo to Donaldsonville, as follows:

The total area of caving per annum is 39,016,000 sq. yds., and the average annual rate of caving per mile of river is 44,186 sq. yds., or a little over 9 acres. The average depth of erosion is about 66 ft., hence the annual volume of erosion per mile of river is 972,092 cu. yds. The total average annual volume of erosion from Cairo to Donaldsonville, as derived from these comparisons, would amount to 10 sq. mi., 84 ft. deep. . . The total amount per annum of solid matter passing New Orleans in suspension is computed, from sediment observations, to be about 10 sq. mi., 26.8 ft. deep, or less than one-third of the amount of erosion. The two-thirds and more not accounted for, added to the volume tumbled into the Missouri, goes to build up the bars which obstruct navigation and the points which follow the caving bends by accretions.

In the same volume, p. 418, Mr. Ockerson states for the 802 miles of the Missouri River between Sioux City and the mouth, that:

The average area of caving per annum for the 802 miles is 50,019,000 sq. yds., and the average annual rate per mile of river is 62,338 sq. yds., or about 13 acres. . . . There is no accurate data available for the height of the banks along the Missouri River. Estimated at an average height of 39 ft., would give the annual volume of erosion per mile of river 748,056 cu. yds. The total annual erosion would amount to 10 sq. mi., 58 ft. deep.

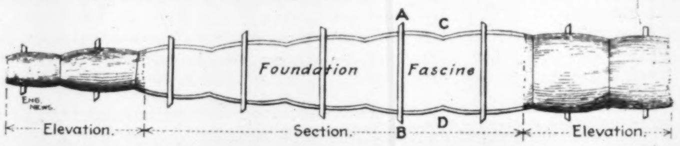
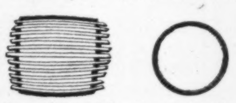


FIG. 1. DETAILS OF A FOUNDATION FASCINE.



There is quite a difference of opinion regarding the best methods of providing the protection, due very often to the different conditions encountered, and also in a measure to the individual experiences and opinions of the engineers in local charge. During the past thirty years much money has necessarily been spent in extensive experiments, with the result that the principal types used at present are, for the Missouri River, a willow mattress that may be termed the basket-woven type, for the upper Mississippi River, this same type, and in addition a board mattress. On the lower Mississippi the solid fascine mattress is now used (the old woven type having been discarded about fifteen years ago). The David Neale system is used on the Missouri, the upper Mississippi, and on the smaller silt-bearing streams. In addition, the pile dike with foot mattress is used on all of these streams, but principally in an effort to close chutes or to deflect currents.

In Vol. XXXV., of the Transactions of the American Society of Civil Engineers, is a paper entitled "Bank Revetment on the Lower Mississippi," by the late H. St. L. Coppee. The paper contains a very detailed description of both the woven and the fascine types of mattress work.

From this paper the following quotations and notes are made:

While the mooring lines are being placed, the head of the mattress is under construction. Hardwood poles, as large as can be conveniently handled by a gang of men, and reasonably straight, are laid in two lines on the ways, over and parallel to the inner gunwale (of the mattress barges). These poles lap each other 10 to 15 ft., the two lines breaking joints. Where they lap they are spiked together every 2 ft., and also tied together with galvanized wire at intervals of 10 ft. This line of poles is equal in length to the width of the mattress. Upon these poles, at intervals of about [illegible] ft. and at right angles to them, the butt ends of the weaving poles are securely fastened with spikes and wire. Upon these latter another set of poles, similar and parallel to the first, are placed, spiked and wired, and the whole head thus formed securely fastened with wire.

The weaving poles are live willow or cottonwood brush, reasonably straight, and 4 to 6 ins. in diameter at the butt, and from 25 to 30 ft. long. To facilitate weaving, all knots are trimmed off and the top and bottom quickly smoothed with a drawing knife. The brush used for weaving is live straight willow of any length above 25 ft., and from 2 to 4 ins. at the butt. It is passed from the brush barges to the weavers, who work in pairs, and is woven into the mattress. The butts are placed under one weaving pole and 2 ft. beyond, being woven at the other end over the next pole, under the third, over the fourth, and so on, the light ends being always left on top.

A strip 5 ft. in width is woven thus; in the next 5 ft. the butt is reversed, and so on, the butts changing directions every 5 ft. When the mattress is woven to within 2 ft. of the end of the poles, giving about 22 ft. of mattress, it is swung into position with the accompanying barges. This shift is then launched down the mattress ways, care being taken not to allow it to slip entirely into the river, check lines being used to prevent. A new set of weaving poles is spliced to the projecting ends of the first set, the butts of this set being spliced to the tops of the preceding one, after having been pushed into the mat about 3 ft., thus making a lap of 5 ft. Two spikes and two wire lashings are used to fasten each splice. The weaving is continued as described to within 2 ft. of top of second set of poles, when another launch is made, and so on, until the full length of the mattress is obtained.

In the fascine mattress no weaving is done, but after the head is constructed the willows are placed in a long row or bundle (parallel to the head, which is perpendicular to the shore line), and tightly compressed and bound every 3 ft., so that it is 12 ins. or more in diameter and of length equal to the width of the proposed mattress. These fascines are closely bound together one after the other by means of wire strands which run continuously through the mattress.

Both types of mattress are strengthened by the use of wire strand (particularly the woven type) being interlaced both longitudinally and transversely through the same and clamped together at intervals. After launching (in both forms of mattress) a grillage of poles is placed on top in lines about 8 ft. apart, and in two layers one above the other, the lines being perpendicular to each other; all wired securely to the weaving poles or cables as the case may be. This grillage prevents the rip rap or ballast from sliding off when the mattress assumes its inclined position on the bank of the river, to which position it is sunk by means of rock ballast.

The mattress work just described is used to protect the portion of the bank below the medium low stage; the portion above this line after being graded off to an even slope, is paved with rip rap, as a rule. In protecting a river bank with this system it is the usual practise to place continuous work over the part it is intended to hold.

It is stated in the paper that although it was expected that the fascine mattress would cost much more than the woven, it was found that the additional expense was slight. This has since been verified many times over. And except to strengthen the work, and possibly to change a few minor details, the fascine mattress is to this day built as described in that paper.

To those familiar with the details of both types, it is unnecessary to say that the fascine is the best and should be used to-day wherever the woven type is being placed. It is more pliable, thereby adapting itself more readily to the abrupt changes that usually take place from the scour along the outer edge. It is tighter, thereby lessening the chances of scour through the mattress. It is not necessary to use only straight clean brush of a reasonably uniform size. And it can be built with about the same plant or equipment.

The fact that all kinds and classes of brush can be used in constructing the solid fascine mattress is a very strong point in its favor. All

*Engineer of River Protection, Missouri Pacific Ry. Co., Little Rock, Ark.

through the annual reports of the Chief of Engineers, U. S. A., for the past twenty years or more may be found statements expressing the fears of the various engineers in charge that the available supply of brush will soon be exhausted. And such undoubtedly would be the case if continuous work upon a large scale were undertaken.

On the Missouri River the woven type has given good service, but the fascine type will give a better one.*

Our experience with this class of work has not proven to be so good as that of the army engineers. An examination of the several annual reports of the Chief of Engineers, U. S. A., for the past twenty years will not entirely bear out the statement of Mr. De Witt given in the footnote. Mr. W. G. Price, M. Am. Soc. C. E., who had wide experience in the early days of the improvement work on the Mississippi River, states in Vol. XXXIII., No. 10 of the Proceedings of the American Society of Civil Engineers:

> The revetting of caving banks by a continuous mattress has certainly not proven to be a permanent form of improvement in many places, and wherever such a mattress is located for a long time in a place where it is opposed to the river flow, it must fail.

For the standard mattress work of the woven type on the Missouri River it must be stated, however, that it is of a first-class quality, being very closely woven, with selected brush, and by high-priced labor. This latter, however, is one point against this class of mattress when compared with the fascine type.

The best record at hand is that given in a discussion by Mr. Arthur Hider, M. Am. Soc. C. E., of a paper presented by Mr. A. J. Nolty, U. S. Asst. Engr., before the Memphis Engineering Society a short time ago. The paper covered the fascine revetment in the Third District, Mississippi River, during the period 1895 to 1906. Mr. Hider shows the cost of maintenance and repairs at 1.83% per annum, and the cost of plant depreciation 0.9%, or a total of 2.73% per annum for the ten years.

It should be stated at this point, however, that previous to 1895 the woven type was generally used on this District; and that a large part of the fascine mattress referred to was built to replace the woven mattress previously destroyed.

The belief seems to be widespread that the willow brush when kept continuously beneath the water does not deteriorate; in other words, remains permanent. Some years ago it fell to the lot of the writer to examine into the question of the permanency of the different materials used in river protection work. Suitable appliances were employed to pull up from the bed of the river pieces of the willow that had been placed in the mattress work from five to ten years previous to the date of the experiments; all of them from a depth not less than 30 ft. below the low-water stage. In every single instance the brush (in sizes from 1 to 3 ins. in diameter) had almost entirely lost its strength against bending and breaking, the breaks being clean and without any splinters. However, there was no diminution in size; and it is believed that such material, if continued in a fixed position, and not subjected to bending, would furnish protection against scour for a long time to come; in other words, the life of the mattress lying in a fixed position would depend upon the length of life of the wire fastenings that are holding the brush together. Much of the wire examined was found to be very deeply corroded, and some of it practically gone. At the present this point is very much strengthened by the judicious use of wire strand. The woven type of mattress is not so entirely dependent upon the wire fastenings to hold it together.

*Regarding the woven mattress on this river, see "Engineering-Contracting" of Nov. 20, 1907, wherein is published some of the testimony before the Inland Waterways Commission. Mr. W. R. DeWitt, U. S. Asst. Engr., who has had much experience, stated as follows:

> This work properly constructed will stand for twenty years with little or no expenditure for maintenance; the bank below water is permanently protected against scour by the willow mattress, and a little new work placed occasionally on the upper bank will maintain that part of the work.

THE DAVID NEALE SYSTEM.

In the paper previously referred to Mr. Price states as follows:

> The Mississippi has shown that it has power to destroy and carry away almost everything that man has constructed to oppose it. By using a little strategy in design, however, the river can be compelled to use its mighty power to dig foundations for permanent improvement works. This can be done, and has been done, by making the form of construction of these works to be fixed points, so that the river can not disintegrate them; it is known that it can, and will, and it is by taking advantage of this undermining power that the point can be made a fixture. By designing the structure so that only wood and stone, properly bound together, form its permanent parts, the forces acting against it can do nothing but undermine it and sink it in the sand, while more of the same material is piled on top of that which is sinking, and a depth of foundation is soon reached which the river will not cut under.

The above paragraph so nearly describes the plan and method of the David Neale system, that it is given before entering into the explanation of that system. However, it must be noted here that stone does not enter into the construction of the part of the work that will constantly be below the surface of the water, it being so built that it will collect sufficient mud and sediment to sink and hold it in place.

The brush for this work need not be carefully selected, but may be quite variable as to quality, size, and shape. With a supply of this material on hand, we place a layer 6 to 12 ins. thick, 40 to 100 ft. long, and 5 to 10 ft. wide, upon a barge or upon the river bank, taking care to have this layer upon thick poles a proper distance apart so that wire and cable or strand can easily be passed back and forth underneath the whole, the brush to be laid closely and with broken joints. Across this layer or bed, place bundles of brush 6 to 8 ins. in diameter, 7 to 12 ft. long, and 5 to 10 ft. apart as the case may be; the ends of these cross bundles should project about a foot over each side of the brush bed. Now along each longitudinal edge of the bed, and on top of the cross bundles, place a continuous bundle or fascine of brush, of similar thickness to the cross bundles, next more cross bundles directly above the others, then longitudinal bundles, and so on until the whole is from 5 to 10 ft. high. In a few words, build up as though it were a rail or pole pen, except that in this case a long pen with partitions is made, care being taken to have the ends of the poles or bundles project out a foot or more. When the brush has no leaves, interstices will be left between the bundles. Fill these with brush tops, hay, straw, or corn stalks, so as to present comparatively tight sides and partitions. On top of the whole place a brush top or cover similar to the bottom bed. With a suitable appliance, next compress and bind tightly with wire or wire strand at intervals of from 5 to 10 ft., producing a large cellular fascine or bundle of hollow cells. The smaller dimensions will give the minimum and the larger ones the maximum sizes of fascines as generally used on the Missouri River to-day. The description would indicate a cylindrical or straight-edged construction, but in actual practice the fascines are built cigar-shaped, which gives them increased strength to resist crushing before they are entirely filled with mud. (Fig. 1.)

After securing the upper or smaller end to a dead-man or post by means of a line or cable, the bundle is launched into the river and floated into place. Within a day or two it will collect enough mud to cause it to settle to the bottom. If not, bags of sand or a sand pump may be used. When once on the bottom it soon becomes securely anchored into the sand through the agency of the currents, and the process of filling is soon completed. Not one pound of rock is necessary to accomplish this result.

This as described constitutes one of the units. They can be placed side by side, and one layer on top of the other to build up a large deflection dike. The usual practice, however, in constructing such a dike, is to build from 6 to 10 of these large cigar-shaped units in progressive lengths of from 30 to 100 ft. and then launch them in such a manner as to form a large triangular-shaped mattress, the upstream end being a point against the bank at the water's edge, the downstream and extending out from 30 to 100 ft. on the surface of the water, and the outer edge or side of the triangle being at an angle of from 30° to 40° with the bank line. (Fig. 2.)

On top of this mattress is now started what may be termed a mud cell raft, the outer edge and lower end being set back from 5 to 8 ft., leaving a step of that size around these two sides. This raft is built exactly after the manner of the fascines, but is continuous, as there are no short bundles of brush except toward the upper point of the mattress. In other words, it is built after the manner of a log house with many rooms, with the rooms from 5 to 8 ft. sq. This raft is extended in and over the upper slope of the bank, as it is built up in height, the slope having previously been graded to 1 on 1½. For about every 5 ft. of elevation around the outer edges step back as mentioned before, finishing the part left out with a covering of brush. Keeping the top of this work on about a 5 on 1 slope, the upbuilding continues until the dike ceases to settle, when a brush covering is placed over the whole, with heavy poles on top placed up and downstream to ward off drift and ice. If the dike eventually sinks, more work can be placed on top.

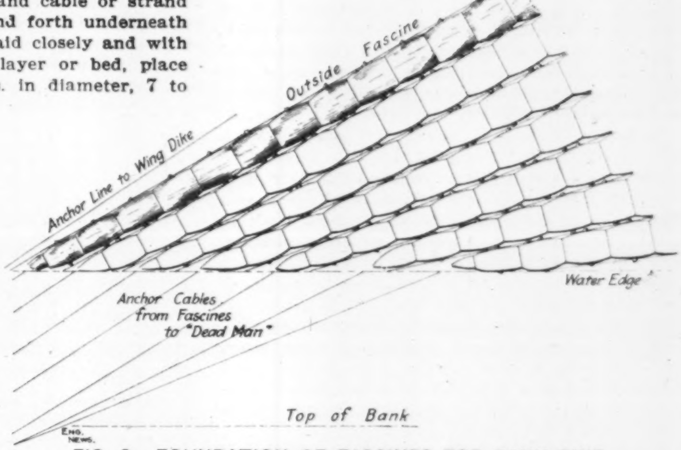


FIG. 2. FOUNDATION OF FASCINES FOR BANK DIKE.

The brush is not carried to the top of the bank, but riprap is used to make this part more permanent. It can readily be seen that except along the outer edge and on top there is no further use for the wire fastenings. If extra care is taken to secure these parts of the dike with heavier wire strand, or by bolting heavier poles so that they will prevent the brush from becoming loose, the life of the work is much prolonged. (Fig. 3.)

The steps referred to above have the effect of very materially reducing the eddy action below the dike; in fact they nearly eradicate the same when properly constructed. Experience, however, is necessary to accomplish this result. The effect of the dike is to cause the water to glide off smoothly and to deflect slightly the main current from the bank. In order more throughly to deflect the lower currents, and to prevent excessive scour at and below the outer corner of the bank dike a mattress of the smaller sized fascines, the whole commonly termed a wing dike, is next constructed in the following manner. (See Fig. 4.) To the outer end of a strong cable attach and sink a chinese anchor or mud box, in a position about 40 ft. below and 50 ft. outside of the outer corner of the bank dike. This cable is securely fastened to a dead-man on the bank about 100 ft. above the upper corner of the dike already placed. Cellular fascines about 30 ft. long are built and fastened to this large cable with a short piece of cable and

a slip ring, and when launched overboard are carried down by the current and sunk into place one after the other by the weight of the sediment they collect.

The space between the chinese anchor and the bank dike is completely covered or filled in, two or more lead cables being placed if necessary to accomplish this result. Dependent upon conditions, and the amount of deflection it is desired to give the river at this particular point, these fascines can be piled in one layer over the other. Care must be taken in building the fascines for the wing dike, particularly the ones that will come on top, to make them strong and to bind them with heavy strand or poles in such a manner that they will not soon come apart. The dike next downstream can now be located just above the point at which the currents again strike the bank. The distance varying very much dependent upon conditions.

Repairs to this class of work usually consist in replacing the top cover and in strengthening the upper bank work; also in building up a dike that has settled unduly. It appears that nearly all of the settlement takes place during the first season of high water.

Sometimes eddies are induced, and when this is the case they should be broken up by rolling in a fascine or two or by building a small foot-mattress, but ordinarily the dike when completed does not cause strong eddies, this trouble often occurring before it is finished.

There are a great many different methods as to details, dependent upon the stage of the river, the conditions encountered, and the material obtainable. The description given covers the class of work suitable for the Missouri River, and as built at medium and low water stages.

So far as the writer knows this class of work has never been attempted in the Mississippi River below Cairo. But to those familiar with the construction of protection works on this river, and whose memories carry them back to about 1887 and 1888, when we wrestled with the intermittent crib dike system, it is unnecessary to say that it can be placed, and be made of sufficient strength, by the use of large poles or even piles that have been cut down at the corners and intersections as in building a log cabin, and fastened together with wooden pins and large wire strand or cable, to withstand the constant impact and scour to be encountered in most cases.

The question now to be decided is, whether it is necessary, as was the case with the old crib dikes, to place solid protection over all the space intervening between the dikes, in order to hold the dikes themselves from being flanked and dropped to the bottom of the river. Some of the cribs placed at that time have held together to this day, and one or more can be seen at low water stages, but on the opposite side of the river from that on which they originally were placed.

CRIB-DIKES.—In the report of the Chief of Engineers U. S. A. for 1888, p. 2208, will be found some sketches showing plainly the method of constructing these crib dikes, and in other parts of the reports for about that date will be found descriptions, from which it may be noted that they consisted of a series of connected pole pens, built up somewhat like the cellular fascines are now built, except that the cells or pens were pyramidal in shape with the point down, and were filled with rock or riprap. The crib dikes were much larger than the fascines described, being built up in from three to four layers, each 8 ft. high, the bottom layer 32 or 40 ft. wide as the case might be, the top one 8 ft. wide, and the whole about 350 ft. long or of sufficient length to reach out beyond the deepest water. They were placed in a line perpendicular to the bank, a woven mattress from 100 to 200 ft. wide having previously been placed as a foundation. It is believed that the undermining of these dikes was brought about primarily through the failure of the mattress foundation, and that this was hastened by the eddy action induced by the cribs themselves.

PILE CROSS-DIKES.—The pile dike system of work is not now in general use, but when it is used as a means of protecting a caving bank by deflecting or warding off the currents, it is usually protected with a foot-mattress of standard construction. So here again the resistance to undermining and the stability of the work itself is chiefly dependent upon the life of a willow mattress. This fact is now generally recognized, and when protection against erosion is the main object desired, it is mattress work alone that is used.

The usual manner of constructing a pile dike is to drive a double row (sometimes a triple row) of piles, the tops being up near the high stage of the river, all being thoroughly braced together, the piles being about 8 ft. apart each way; at times the interior space between the rows is filled in with brush and riprap, but more often a screen of poles or other material is constructed in such a manner as to retard the free flow of water. The foot-mattress mentioned above is almost always a part of this construction, and is placed to prevent scour and undermining. These dikes are built at all angles with the direction of the bank line, but quite often they go out at about right angles, with a head wall on each, or a trailing wall (pile dike) connecting the ends of the different cross dikes.

In the Trans. Am. Soc. C. E., Vol. LIV., p. 305, Mr. S. Waters Fox, M. Am. Soc C. E., states as follows:

There are two things which mar the efficiency of pile cross-dikes:

(1) Immense quantities of driftwood, borne on the surface and at all depths during flood stages, find lodgement to a greater or less extent in unevenly distributed masses upon the structures. This often results in breaching the dike, by overturning it, or, by crushing the structural parts. Scour, induced by concentrated flow or excessive head, may be a primary, or contributory cause, and, of course, once a breach is formed it rapidly widens, due to scour, until head has been dissipated to such an extent that velocities are reduced below that at which scour can take place. Even though the structure be not breached, its curtain may be rendered practically inoperative by driftwood, so that the flow through the dike is very uneven and the deposits formed are correspondingly irregular.

(2) There is always more or less of a pot-hole or trench at the stream end of the dike, which attracts the flow and prevents the formation or maintenance of deposits quite out to the end of the structure; more or less eddy action is in persistent attendance, and, as the structure deteriorates with age, constant exposure to the forces of the river is more and more likely to destroy it, and, once the outer end of a dike is destroyed, the remaining portion yields more readily.

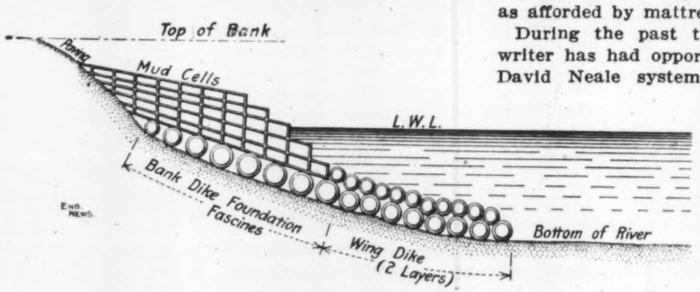


FIG. 3. CROSS-SECTION OF NEALE SYSTEM OF RIVER IMPROVEMENT.

In the discussion before the Memphis Engineering Society, previously referred to, Mr. Arthur Hider says:

One of the main objections to the use of pile dikes for construction works has been found to be, that at high stages they formed obstructions to the flow, and being constructed on sand bars were undermined by any change of current and were destroyed, as they offered no resistance to scour below the bottom of the piles, which, when used in these dikes, seldom reached below low water mark. Gaps were often caused by drift accumulations as described. But that these dikes were successful in many localities in deflecting the main channel of the river, aiding the silting up of Island Chutes, and the formation of sand bars has been demonstrated.

BANK HEADS.—The intermittent dike plan of bank protection was tried about ten years ago on the Missouri River, when Col. Amos Stickney, Corps of Engineers, U. S. A., designed and introduced a device which he termed a "bank head." In the volume of the Transactions, Am. Soc. C. E., previously referred to, Mr. Fox gives a complete and explicit description covering the construction of these "bank h[eads] and explains what is was expected to [accomp]lish by their use. It shows what actually hap[pened] during a period of several years [after] they were built, the net result being that th[ey] failed. The writer is of the opinion, however, [that] the theory was not far wrong, but that [the] trouble was in constructive detail, it being s[uch as] to allow the river to break up and carry [away] piece after piece. In a few words these ban[k] heads were constructed principally of piling [and] riprap, with some brush placed in curt[ain] walls leading from the outer circle of piles [to] the bank. The outer circle of piles occu[pied] the arc of a circle about 700 ft. in diam[eter] and having a middle ordinate from the bank [li]ne of about 90 ft. Much riprap was placed in front of this outer circle of piles as the chi[ef] protection against undermining. To quote Mr. Fox:

There was reason for belief that, after some further experimentation, on lines suggested by the experience gained, a satisfactory system of bank-head protection could be devised; but, at this juncture, appropriations failed, and the ultimate success of bank-heads as a practical, economical means of bank protection on the Missouri River, yet remains to be demonstrated.

In designing these bank-heads it was figured that a certain amount of riprap would protect the structure against an assumed amount of scour. It is believed that a great part of the trouble was due to this assumption.

The theory with all spur or deflection dike work is so to protect a portion of the bank, or so to deflect the currents that they will not attack the bank immediately below the dike, and thereby save the expense of continuous protection as afforded by mattress work.

During the past two and a half years, the writer has had opportunity to examine into this David Neale system very closely, being confronted at first with the fact that very few were sufficiently familiar with the system to be able to describe its construction. This still being the case, although to a somewhat less extent, it is the aim so to present these notes that others having a wider experience and a more thorough knowledge of river protection works in general can intelligently discuss the same, and point out the points that should be strengthened.

In endeavoring to form an opinion regarding the length of life of this class of work by making an examination of that placed years ago, it must be considered that the methods of building have been materially changed, especially in quite recent years, so that now there is a much stronger class of protection. It is simply marvelous that in some cases the older work held together long enough to be sunk in the place it now occupies after many years. Even at this day, work is being placed under this system that in all probability will not hold together many years if continuously subject to attack by the river. There are no specifications covering the work, and it is being placed very often in accordance with the individual ideas of the foreman in charge.

The writer must admit that his first reason for recommending this class of protection was based chiefly upon the fact that it appeared to be the best effective work for the money. Since more carefully studying the patent papers covering the same, and watching the construction of the work, he is nearly convinced that the general constructive details are the best now in use for the accomplishment of the results desired. The uncertainties are due in part to the fact that until the few recent years, no location or cost records were kept, and therefore it is not possible to know how much was lost nor to figure how much it would have cost to so repair as to maintain effective protection.

Our records covering the past two years show the work to be highly satisfactory. An examination of the work placed years ago shows many unsatisfactory results, chiefly, it is be-

lieved on account of the acceptance of the claims made by the inventor, that it would be permanent. No repairs were made, or if made they were of little benefit because placed at too late a date. We all know that this work as well as any other work constructed of willow brush, under the conditions in question, is not permanent and this is particularly the case with the parts that are above the low water stages and subject to the attacks of each recurrent high water. Where failures are noted it appears that it was, in many cases, the upper bank protection that went out first; as in many of the instances the lower portion still remains.

Extravagant claims are advanced for this system, and the impression has gained headway that an effort is being made to protect caving banks with corn stalks, hay, and straw mixed with a small amount of willow or other brush. In fact this system consists in the building of a frame work with willow brush or poles, and the use of the corn stalks, hay, etc., merely to close up the interstices a sufficient amount to enable the frame (which is the main feature of the protection) to collect and hold the mud and sediment. As a matter of fact, during the season of the year that the brush contains the leaves, there is no need of corn stalks, hay, or straw.

If it is concluded that the frame work as previously described is not strong enough, larger brush and poles can be used at small additional cost. Other things being equal, it needs no argument to prove that, the same brush, bound together with the same grade of material, and placed in the same river, will not in itself last as long in one system as in another. The hay and straw is not a necessary part of the work after the same is well fixed upon the bed of the river. Even if one or more pockets did become emptied of their mud deposit, by reason of the hay or straw floating out and allowing the currents to act upon the mud, there are many other pockets or cells next adjoining from which it will not be so easy for the river to remove the mud.

In the Mississippi River where the work would necessarily have to be constructed of large poles or even logs, the hay and straw would form a very important part of the work, and it is principally for such cases that it is intended. One of the very strong points in favor of the use of this system is that it permits the utilization of a very large variety of materials in its construction, thereby allowing a cheap form of material that is near at hand.

Next as regards the manner of placing the materials forming the protection. Considering the evidence at hand, showing that the brush is liable to undergo changes in a few years that will destroy its bending strength to a certain extent, it is plainly evident, to the writer at least, that there is much more chance of its holding together when placed en masse than when spread out in a thin layer. The question of being able to hold a caving bank by building intermittent dikes, has not yet been thoroughly demonstrated, but this system seems to offer the best form of dike that could be used towards the accomplishment of that result.

Granted that these dikes can be placed so that they will hold, then this system possesses another advantage over the solid mattress system and that is that the first dike can be placed at the worst caving, and the second one at the next worse place irrespective of their occupying adjoining positions in the final accomplishment of the work. Or again in a case where the river is attacking, and the attack is gradually advancing downstream along side a railroad embankment, for instance, by building one or two dikes this season, the downstream progress of the direct attack can be stopped, and the river slightly deflected. This may suffice or it may be necessary to go there the next and succeeding years and place additional dikes as required further down. Thus the cost may be spread out over several years. With the solid mattress work nearly the whole of the entire length would have to be built the first season to accomplish the final turning of the river, and to insure against heavy loss to the unfinished work.

COSTS.—As stated before, the cost records of this work to date are not such as to enable us to give an average figure, there being a wide variation, dependent upon conditions and location. A contractor who has been engaged upon this class of protection work during the past two years or more, principally upon the Arkansas and Red rivers, is taking work at from $4.50 to $5 per lin. ft. of bank protected, counting from upstream end of upper dike to about 500 ft. below the lower dike, and agrees to repair and maintain the work for a period of two years from date of the beginning. He has entered into an agreement with the inventor whereby he has obtained the right to build the work in certain sections of the country, paying a percentage of the cost of the same as royalty.

It develops that this firm has not made much profit at this figure, partly due at first to inexperience in handling such construction work, and also to the fact that the amount of work thus far presented has not justified the purchase of a suitable and efficient plant.

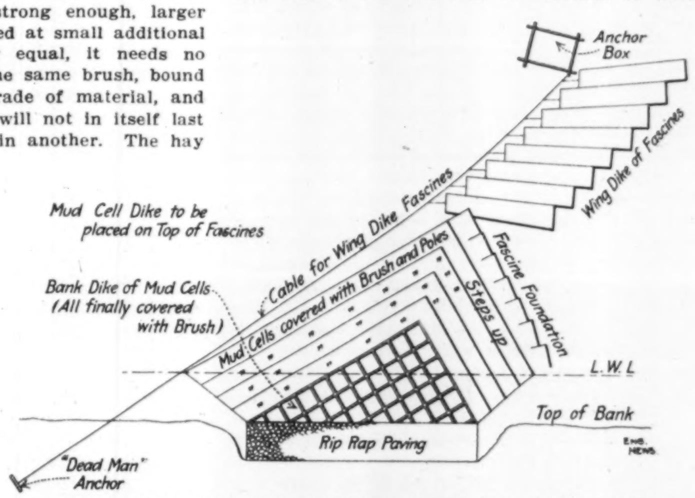


FIG. 4. GENERAL PLAN OF BANK DIKE WITH WING DIKE.

On the Missouri River, where a plant could be quickly and cheaply moved from one point to another, it is believed that the work can be placed in a thorough manner, and a profit returned to the builder under a price of $5 per lin. ft. of bank protected. Roughly speaking, this is not much more than half the cost of building the standard mattress work.

The writer has records showing the cost of work under the David Neale system as low as $2 per ft. of bank, but although the protection in question has withstood the attacks of a bank full river during a period of nearly three months, it has been in place only a little over one year, and it may develop later that additional dikes must be placed between the ones now constructed.

It is an established fact that the Missouri River can often be so turned by a very small obstruction that it will discontinue its attacks on the bank below. The developments in the case just mentioned seem to point in this direction, and to the probability that there will be no need of additional dikes, at least in the near future. This exemplifies the point previously mentioned, that, under this system, by constructing in one season a part of the work deemed necessary to thoroughly protect, you can often so divert the main currents that the balance of the work will not be needed. This, however, applies at points where it is immaterial as to whether or not some additional caving does take place. A point where the river has caved up to the railroad embankment, for instance, should be protected with solid work.

In the testimony before the Inland Waterways Commission, previously referred to, Mr. DeWitt estimates the cost of a plant for building the standard mattress work as follows: four barges 25 × 100 ft., $10,000; a barge 20 × 80 ft., $2,000; steamboat, $5,000; hydraulic grader, $5,000; pile driver, $5,000; or a total of $27,000. It is believed that he has not placed the figures too high.

For building the class of work described in this paper, neither the pile driver nor the grader would be needed. Neither are any special mattress barges used, but it is economy to have plenty of barges for transporting the materials, and therefore it is estimated that a suitable plant would cost $17,000.

The plant used by the Missouri Pacific Ry. Co. in constructing the work that cost $2 per ft., consisted of a second-hand gasoline launch, previously purchased for other use at $800, and three barges about 10 × 32 ft., one second-hand at $35, the other two built at a cost of $90 each, or a total of $1,015.

An association of property owners in the vicinity of Boles, Mo., are at this writing building work with a plant that cost $800.

Neither of the above could be recommended as economical for a contractor's use, and are mentioned merely to bring out the fact that with this system small bodies of property owners can protect their lands from the encroachments of the Missouri River at a cost that is within their reach, or one that the property will bear profitably.

The cost of making the Missouri River navigable is generally placed at about $50,000 per mile of river; this usually contemplates the use of the present standard mattress and dike work as used by the government engineers.

By using the system under discussion in this paper, it is confidently predicted that the same result can be accomplished at less than one-half this cost. And the final cost to the government would be much less, when we consider that there would be a large part of this river whereon the adjoining property could be profitably assessed the entire cost. The chief trouble is to obtain a suitable plant to do the work cheaply; this the government could well afford to furnish.

As mentioned before, this system allows of many modifications making it adaptable to nearly any condition encountered, and permitting its construction by the use of a variety of materials of quite variable sizes. It is constructed in such a manner as to more easily withstand the forces that tend to destroy this class of work. The author can freely recommend it to the careful consideration of any one having river protection work to do.

THE REJECTION OF UNDULY LOW BIDS was commended by Secretary Garfield in a speech before a conference of the Supervising Engineers of the Reclamation Service at Mitchell, Neb., on July 25. The following is an excerpt as given in the "Reclamation Record":

When the bids come in I want the local men never to hesitate to throw out unduly low bids. There is nothing more distressing to the Department than to deal with a failing contractor. The mere fact that it is the lowest bid gives the presumption that it ought to be accepted, but if any engineer knows that a contractor has made a mistake or is not qualified or is not responsible or is negligent in the method of performing his work, that should be one of the prime conditions to be considered in making a recommendation for or against giving the contract to the contractor. I always want the word "responsibility" to be given the fullest meaning that the law will allow it. It must be the responsible bidder in every sense. Much of our difficulty has been in dealing with men who were not responsible.

A PROCESS FOR COPYING BLUE PRINTS without the labor and expense involved in making a new tracing has been recently put upon the market. The blue print, of which copies are desired, is treated successively with three special solutions which transform it into a translucent negative from which any number of prints can then be made in the usual way. Solution No. 1, containing salts of one of the metals, is applied with a brush so as to cover all the lines of the print, which is then placed for from five to ten minutes in a bath of solution No. 2, which changes the deposited metal to a sulphide. The third solution is afterward applied with a cloth or brush and is used to give the print its translucent qualities. This method, which has been patented, is the invention of Mr. E. A. Cunningham, of Ambridge, Pa., and is put on the market by Williams, Brown & Earle, 916 Chestnut St., Philadelphia, Pa.

THE BLUE ISLAND AVE. TUNNEL OF THE CHICAGO WATER-WORKS SYSTEM.

The water supply of Chicago is drawn from Lake Michigan through deep-water intakes connecting with tunnels beneath the bed of the lake, and terminating at pumping stations on the shore. Pumping stations for distribution systems are located at different parts of the city, and most of these draw their water from a series of land tunnels connecting with the intake pumping stations. The latest of the numerous tunnels which thus distribute the main supply to the pumping stations is that known as the Blue Island Ave. tunnel, which is now practically completed.

The main object of this new tunnel is to connect the intake pumping station at Chicago Ave. (near the lake) with the distribution pumping

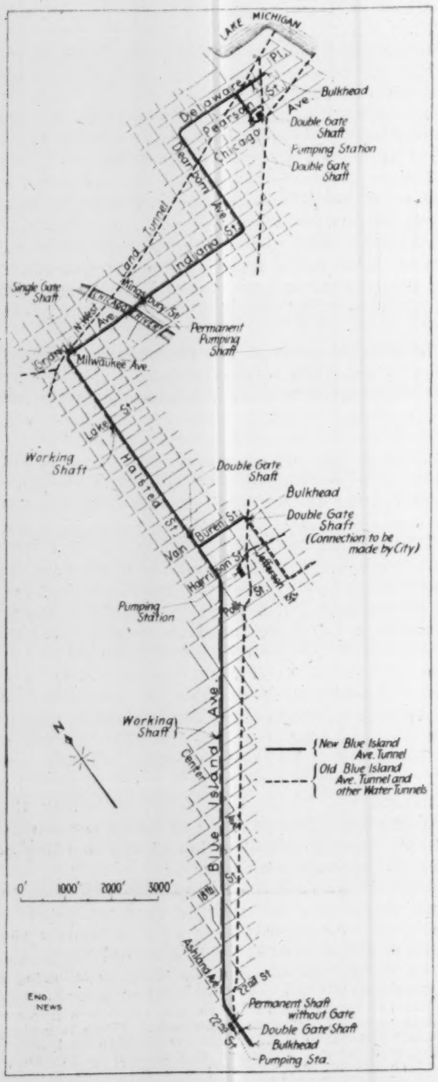


Fig. 1. Map of the New Blue Island Avenue Tunnel of the Chicago Water Supply System.

stations at Harrison St. (near Halsted St.) and at Ashland Ave. (near 22d St.). It is not in itself an addition to the water supply system, but takes the place of an older and smaller tunnel. It will be extended eventually, however (as noted below), so as to form part of an important addition to this system. The old 7-ft. tunnel (built in 1873-75) runs in a direct line between the Chicago Ave. and Ashland Ave. pumping stations, as shown in dotted lines on the plan, Fig. 1. In this way it crosses diagonally under the blocks, and with the increased construction of large buildings it is liable to injury by piles or caissons sunk for the foundatons of new buildings. Such an accident did occur a few years ago to the old Polk St. tunnel, as noted in our issue of Nov. 14, 1907.

In 1907, it was decided to replace the old Blue Island Ave. tunnel by a new tunnel of larger size, following the street lines, as shown by the heavy solid line in Fig. 1. This tunnel is 8 ft. diameter and has a total length of about 26,550 ft. Its branches for connections with pumping stations and existing tunnels aggregate about 1,800 ft. The actual length of tunnel driven was 28,882 ft. At the north or intake end, the main tunnel extends east in Delaware Place to a bulkhead or dead-end near the shore line. A branch runs south from Delaware Place to the southwest corner of the Chicago Ave. pumping station. This connects with existing tunnels served by the station; it has also a spur to the west side of the station. Another branch runs east in Van Buren St. from Halsted St. to Jefferson St., connecting at the latter point (by a shaft) with an existing tunnel which leads to the intake pumping station at 14th St. and the lake front. A short spur connects with the Harrison St. pumping station. The flow capacity of the new tunnel is 180,000,000 to 200,000,000 gals. per 24 hours.

The depth from the street surface to the center line of the tunnel ranges from 34 ft. at the 22d St. end to 62 ft. at the lake end. From 22d St. to Washburn Ave. there is a descending grade to a depth of 38 ft.; thence to Halsted St. it drops to 50 ft. Beyond that point it is practically level till it reaches the river, when it drops to 74 ft. below the surface, rising again beyond the river. The tunnel has curves of 50 ft. radius for its 90° bends in turning from one street to another. At one point, also, it is given a swing from a straight line in order to connect with a working shaft at a street intersection. Here the curves have radii of 40 ft.

The excavation has been mainly in the stiff blue Chicago clay, with very little water. At some points sand pockets and soft clay with water were encountered. For purposes of safety, as well as to exclude water, the greater part of the tunneling was done by the pneumatic system. Some very large boulders were encountered in the clay, and were broken up by the plug-and-feather system for removal. For about 800 ft. on Ashland Ave., near 22d St., the work is in solid limestone rock. For part of this distance the whole work is in rock, while at one end the lower portion is in rock and the upper portion in clay. In the clay, the excavation could be taken out very closely to the neat line, allowing for a 10-in. lining of concrete. For a distance of 400 ft. where the tunnel passes under the Chicago River (about 20 ft. below the river bed), the lining is reinforced by longitudinal steel bars and by rings of 1-in. round bars 12 ins. apart. The rings are set in the middle of the lining. Steel reinforcement is used also in the concrete for the shaft lining and for the gate chambers at the bottom of the shafts. This is shown in Fig. 2.

The concrete was made with clean gravel (up to 1½-in. size) as a rule, but 1½-in. stone was used in some places. It was composed of 1 part cement, 3 parts sand and 6 parts stone or gravel. The forms were left in place at least three days. After the forms had been removed, all obstructions cleared away, and the bottom made dry, the concrete was covered with a thin coat of a plaster made with cement and pulverized stone, 1:2. While this plaster was wet, it was brushed over with a grout of cement and water. The concrete was made as a medium-dry mixture, owing to the fact that it had to be put in place with shovels. For the lower part of the sides, it was shoveled in above the edge of the form. For the upper part, the concrete was dumped on the floor of the heading and thrown back by shovels, being rammed into place with bars.

An interesting feature of the work is the use of steel forms for the concrete lining. This is shown in Fig. 3, and is the invention of Mr. Jackson, the contractor. The ribs were 5-in. channels (with the flanges outward), bent to an inside radius of 3 ft. 10⅝ ins. Each rib was in four pieces, put together with bolts through angle brackets, riveted to the ends. Packing pieces may be placed between the brackets if necessary, as in Fig. 4. Near the lower part of each bottom section was a bracket plate forming a support for transverse 3 x 3-in. tee bars to carry the working floor and tracks. These ribs

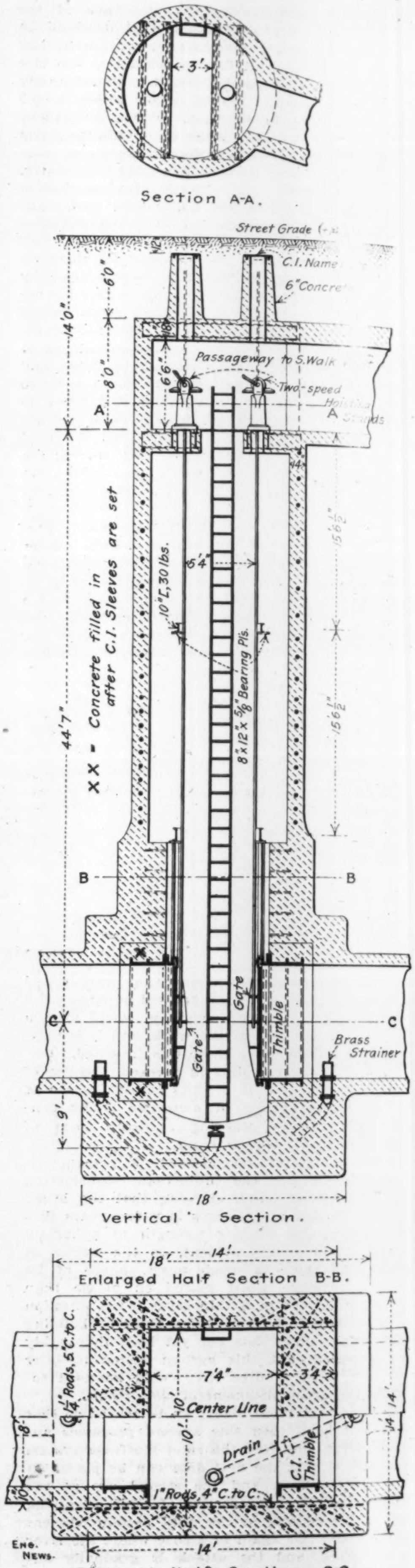


Fig. 2. Shaft and Gate Chamber on the Blue Island Avenue Tunnel (showing Steel Reinforcement of Concrete Lining).

were spaced 36 ins. c. to c. The lagging consisted of steel panels bent to the required curve and fitted to the flanges of the ribs. The ⅛-in. panel plate was 12 x 36 ins., and had an angle riveted along each side of the inner face. With concrete sufficiently wet and well rammed in place against the steel plate, this lagging gave an even surface, but rough enough for a good bonding with the plaster finish. Fig. 4 shows the steel forms in place, with some of the rib sections and panels lying at the side of the tun-

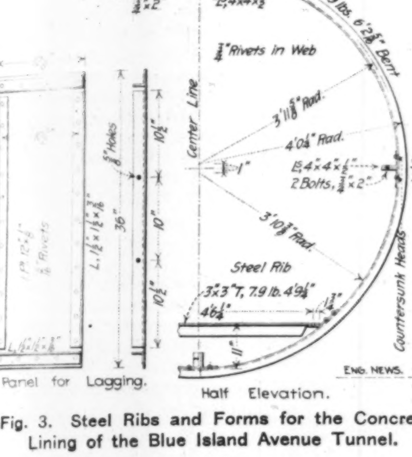


Fig. 3. Steel Ribs and Forms for the Concrete Lining of the Blue Island Avenue Tunnel.

nel. In the front part of the view is shown the exposed face of the concrete with the forms removed. Fig. 5 is a view in the completed tunnel (after the plaster coat had been applied). This is at the curve at Halsted St. and Grand Ave.

The excavation was done by means of spades and draw knives. A track of 16-in. gage was laid for small cars of ½-yd. capacity, which were hauled by mules. Passing places were arranged at suitable intervals. In most cases the cars were hoisted up the shafts and dumped into wagons. At three places, however, inclines were built to the tunnels of the Illinois Tunnel Co. (at a higher elevation than the water tunnel). The muck cars were hauled up by a motor-operated cable and dumped into the narrow-gage cars of the tunnel company, which hauled the material away for use in filling at Grant Park, on the lake front. The shaft elevators were operated by electricity.

There are seven permanent shafts. Five of these are fitted with gates, and one is for pumping out the depressed section under the river. There were also four working shafts. All the shafts are 10 ft. diameter, and have sumps 5 ft. deep. On account of the unfavorable character of the material encountered, the shafts were all lined with the Jackson steel sheet piling, as in the shore shaft of the 73d St. lake tunnel described in our issue of Nov. 14, 1907. The permanent shafts have a 14-in. concrete lining, reinforced by rings of 1-in. and ¾-in. round rods 12 to 24 ins. apart. The rods are in semi-circles, hooked together at the ends. They are set 10 ins. from the interior face of the lining. The working shafts and the cable inclines are closed off by the tunnel lining, and then filled up. Steel bulkheads are built across the inclines, in order to relieve the pressure of the filling against the tunnel walls. Some of the working shafts were on the line of the tunnel; others were connected with it by short side drifts. The details of one of the gate shafts are shown in Fig. 2.

The guide frames of the 8-ft. Coffin sluice gates at the gate shafts are bolted to 8-ft. cast-iron thimbles or sleeves set in the concrete at the tunnel openings. These sleeves are 30 ins. long, with an outer bolting flange 9 ft. 2 ins. diameter and 2¼ ins. thick. A calking groove is provided in this flange, and the joint between the flange and the concrete is packed with tar-oakum and lead-wool. At each gate there is a by-pass 12 x 12 ins. Where the gate shaft is in the middle of the street, its top is closed, and a subway 6 ft. diameter is run from the shaft to a manhole chamber under the sidewalk. This gives access to the shaft platform from which the hand-wheels of the gate mechanism are operated.

The average monthly progress of excavation was about 278 ft. per heading. The maximum monthly progress at any one heading was 613 ft. (for the month of May, 1908). The maximum daily progress at one heading was 21 ft. The excavating gangs averaged seven men, and they worked two shifts of eight hours each. The concreting gangs averaged eight men, and worked the same length of shifts. These gangs also removed and erected the steel centering. The plastering was done afterwards at convenient times by gangs of three or four men. The work was carried on continually in 8-hour shifts. The organization of the men in the gangs was as follows:

Excavating:		Concreting:	
Excavators	3	Shovel'g concrete in place	3
Muckers, loading cars	2	Con. mixer, on surface	2
Car pusher	1	Car pusher	2
Driver, with mule	1	Driver, with mule	1
Total	7	Total	8

A close record was kept of the progress of the different items of work at the several headings, and was plotted on a plan and profile having a scale of 100 ft. to the inch. This shows not only the progress of the work, but also the exact location, with all curves and diversions, so that it will form a complete permanent record for the tunnel. In transferring the survey lines from the surface to the headings, use was made of the inclines connecting with the Illinois Tunnel Co.'s tunnels, and of the inclined chutes used by that company for delivering rails to its tunnels. At some points, 6-in. pipes were driven in the ground to a sufficient depth to be encountered by the headings. In most cases the lines of the different headings met with close accuracy.

The contract for the Blue Island Ave. tunnel was awarded in April, 1906, to George W. Jackson, of Chicago, at $680,000. The cost has been about $19.70 per ft. The construction was to be completed by the end of 1908, and this requirement has been fulfilled. The work has been under the general direction of Mr. John Ericson, M. Am. Soc. C. E., City Engineer. Mr. W. D. Barber, M. Am. Soc. C. E., Assistant Engineer in the Department of Public Works, has been Resident Engineer in charge of this tunnel.

EXTENSIONS.—The future extension of the new tunnel has been mentioned already. At the south end it will be extended south in Ashland Ave. to a new pumping station at 31st St., which will take the place of the present 22d St. station. At the lake end the main tunnel runs under Delaware Pl. nearly to the shore, and a branch under Pine St. connects with the Chicago Ave. pumping station. The main tunnel will be extended eastward in Delaware Pl. and under the lake to the Carter Harrison intake crib. When this new intake tunnel is built, the old "two-mile" crib will be abandoned, together with the three intake tunnels which extend from it.

A complete description of the various lake intake cribs and tunnels of the Chicago water supply system was published in our issues of Aug. 31, 1899; Oct. 18 and Nov. 8, 1900, and Nov. 14, 1907.

FIG. 4. STEEL FORMS IN PLACE IN THE BLUE ISLAND AVENUE TUNNEL.
(In the immediate foreground the forms have been removed, exposing the face of the concrete lining, ready for the plaster coat.)

FIG. 5. INTERIOR OF THE 8-FT. BLUE ISLAND AVENUE TUNNEL, SHOWING THE FINISHED SURFACE.
(This view shows the curve at Halsted St. and Grand Ave.)

A PNEUMATIC RAILWAY AT CHICAGO, AND A REVIEW OF PNEUMATIC TRANSPORTATION SYSTEMS.

The pneumatic railway, with the proposition to employ an air current to propel cars through large or small tubes, dates back nearly 100 years, and has been experimented with at various times. The latest revival of this system is at Chicago, where experiments are being carried out on a practical scale. This new development is intended for mail and parcel service as well as for passenger service, the difference being principally in the size of the tube or conduit. The vacuum system is used, instead of the pressure or plenum system. It is the invention of Mr. Joseph J. Stoetzel, who has applied for patents, and it is being handled by the Universal Pneumatic Transmission Co., 135 Adams St., Chicago.

An experimental line nearly half a mile in length has been built at Forest Park, a Chicago pleasure resort, and has been utilized as an attraction as well as for experimental work during the summer. The actual length of the concrete tunnel or conduit is about 2,200 ft., forming a loop. It has several curves and grades (the maximum grade being 9½%), in order to demonstrate the practicability of the system. The tunnel is 4½ ft. wide and 6 ft. high, with vertical walls, an arched roof and a flat floor. The track consists of light steel channels, in which ride the flat-tired wheels. The cars have a light steel framework, covered with wire netting to keep passengers from coming in contact with the walls of the tunnel. Each car is carried by a pair of small trucks, between which the underframe is dropped below the level of the axles. At each end of the car is a steel plate diaphragm which corresponds to the section of the conduit, but no attempt is made to form a close seal between the diaphragm and the conduit. Each car is 12 ft. long and weighs 1,300 lbs. empty. It can seat ten pasengers, but 17 persons have been carried. The loaded weight may be from 3,000 to 4,000 lbs.

The air current is created by an exhaust fan driven by an electric motor. No details of the plant can be given, as the most efficient and economical size and power have not yet been determined. The vacuum, as shown on the water gage, varies from 2 ins. to 3 ins. to make the run of 2,200 ft. in about 75 seconds. The cars are operated singly, and as many as four cars are in the tube at one time. The volume of air between the several cars acts as an air cushion, and prevents the cars from running together, so that collision is said to be impossible. The plant is extremely simple, especially as compared with the large air-pumps and engines required for the earlier railways of this class, which are noted below. Fans, however, were used for this purpose as long ago as 1853.

A 24-in. tube is proposed for mail and parcels service, and a short experimental concrete tube of this size has been built. The parcels or mail bags are placed in small cars or carriers.

PNEUMATIC TRANSPORTATION SYSTEMS.

The pneumatic system of transportation (by either vacuum or compression) dates back nearly 100 years, as already noted. It has been actually used for railway operation, and in modern years it has been adopted extensively for mail service in large cities. It will be of interest to review briefly the use and development of this method of transportation. It may be considered under three divisions: (1) The tunnel railway system, in which the track and car are within the pneumatic conduit. This has been used only experimentally. (2) The tube railway system, in which the car is attached to a piston traveling in a tube laid between the rails. This was used in regular service on different lines between 1840 and 1860, but has long been abandoned. (3) The tube system for the transmission of packages. Here small carriers run in closed tubes. This has been developed on a commercial scale and is now used somewhat extensively for mail transportation, etc.

THE TUNNEL RAILWAY SYSTEM.—The pneumatic system of propelling small carriers in tubes and larger passenger cars in tunnels or conduits was proposed in 1810 by George Medhurst, an English engineer. In 1812, he suggested using a small tube having a piston connected in some way (not then explained) with an ordinary railway car. In 1827 he described his method of effecting this connection. He proposed to use a slotted tube, to permit the passage of a bent bar or rod connecting the car with the piston. The slot would be covered with a belt of leather fastened along one side, so as to be raised by the passage of the bent rod. He also proposed (in 1827) to operate the system either by forcing air behind the piston or by exhausting it in front of the piston. In 1824, the Medhurst plan of operating passenger cars by vacuum in a tunnel was advocated by John Vallance for a railway between London and Brighton. About 1826, a short length of tunnel of such size as to admit an ordinary railway car was built and equipped for experimental purposes. Around the car was a diaphragm corresponding to the tunnel section, and the edge of this was fitted with bristles to form a packing between the car and the tunnel wall. Nothing came of this project.

The tunnel system was revived in the United States by Alfred E. Beach. In 1867, he exhibited at the American Institute Fair in New York a 6-ft. tube 107 ft. long, in which ran a car carrying ten people. A 10-ft. fan running at 200 r. p. m. was used to create a vacuum. Following this, he secured a franchise for an underground pneumatic railway under Broadway, New York. This was actually commenced in 1869, an 8-ft. brick-lined tunnel being built for a distance of 200 or 300 ft., extending north from Warren St. The tunnel had benches at the sides for the rails. The car had its wheels under the longitudinal seats, and the floor was dropped between the rails to the invert. A fan was used to create the air current. The first trip was made Feb. 26, 1870, and experimental trips were made from time to time up to 1883. This old tunnel was destroyed in building the present subway. Since that time, the pneumatic tunnel system has been dormant until the present experiment in Chicago, noted above.

THE TUBE RAILWAY SYSTEM.—It has been mentioned that Medhurst in 1812 proposed the small-tube system as a modification of his large-tube railway system. In 1834, Henry Pinkus, an American engineer, patented in England a modification of Medhurst's continuous flap valve, but nothing came of this. The idea was taken up later by another English engineer, Samuel Clegg, who patented a new form of valve in 1839. He associated himself with the noted engineering firm of Samuda Brothers, who became active promoters of the system. After experiments with models, they built at their own expense a railway half a mile long near London, having a grade of a little over 1%. This had a 9-in. tube. It was put in operation in June, 1840. The valve to close the slot was a strip of leather riveted between iron plates, the upper plate being wider than the leather and resting upon the top of the tube. The leather flap was secured along one edge, and was raised in advance of the plate attaching the piston to the car by means of rollers on the piston rod. Another special device pressed it down and sealed it as the car passed. A 16-HP. engine was used, and could create in one minute a vacuum equal to 18 or 20 ins. of mercury. This sufficed to carry 13½ tons up the grade at 20 m. p. h. With a vacuum of 23½ ins., a 5-ton load could be carried at a speed of 45 m. p. h. This system naturally attracted great attention at a time when the locomotive was in its infancy, and it was advocated by many noted engineers of the day.

The system was adopted for a railway 1¾ miles long near Dublin, and this was opened in 1843. A 15-in. tube was used, and an engine of 100 HP. operated an air pump 67 x 66 ins. There was a long grade of 0.86% and a maximum grade of 1.75%. This railway was operated until 1855, when the line was leased to another road, and became part of a system operated by locomotives. A line from Forest Hill to Croydon (near London) was built about 1845; this was about five miles long, and had a maximum grade of 2%. It was afterwards extended. The tube was 15 ins. diameter. There were three pumping stations, one at each end and one near the middle. Each of these had an engine [illegible] HP. This road was in operation during [illegible]. It was abandoned on account of the tub[illegible]g too small for the heavy traffic, and an [illegible]pt to carry a high vacuum resulted in l[illegible] and friction. Another reason was an exte[illegible] of the line to make it form part of an exist[illegible]ailway system.

In 1844, Mr. Brunel adopted the pne[illegible] system for a portion of the South Devon [illegible] from Exeter to Newton, 20 miles. The tu[illegible] was 15 ins. diameter, and the line was in six [illegible]sions, with a pumping engine for each. For the heavier grades on the remainder of the road [illegible] Plymouth) it was proposed to use larger tu[illegible] with a piston that could be expanded and contracted to fit the different diameters. The first trip was made in 1847. The expenses of operation were considerable, and the flexible continuous flap-valve was a special source of trouble. The traffic was light and the expenses exceeded the earnings, as the engines and boilers had to be under steam all the time, although the engines were mainly standing idle. In view of these facts, and of the fact that this part of the line formed part of a railway system having 200 miles operated by locomotives, it was decided to abandon the system, which was done in September, 1848.

In France, the system was first introduced about 1845, by Mr. Hallette, an engineer, who devised a valve composed of inflated elastic tubes. The French government sent another engineer, Mr. Mallet, to examine the Dublin line, and on the basis of his favorable report the pneumatic system was adopted for the last 1½ miles of the line from Paris to St. Germain (12½ miles). This was opened in 1847. The line had a 24½-in. tube, and two engines of 228 HP. The vacuum was ordinarily 15½ to 20 ins., but sometimes 27 ins. at the steep grade of nearly 3%. With the increase of traffic and weight of trains, the capacity of the plant became too limited and the system was eventually abandoned in 1860, after 14 years of regular service.

The pneumatic tube railway system was revived in this country in 1890, when Mr. C. H. Gobel exhibited at Philadelphia a system devised by him. A 6-in. tube was used, with a track about 80 ft. long, carrying a car seating about 15 passengers. The special feature was the method of closing the slot in the tube, which was covered by steel plates 6 ins. long. These were pushed back horizontally by the grip plate, which had attached to it a casting having a curved slot to engage with a pin on the top of each sliding plate. This experimental plant was described and illustrated in our issue of March 22, 1890.

THE CLOSED TUBE SYSTEM.—The pneumatic transmission of telegrams and mail matter in closed tubes dates back to 1853, when a short 1½-in. tube line was built in London by J. Latimer Clark, an English engineer. This was for a telegraph company, and was used to convey messages from a branch office to the main office. It was operated on the vacuum system. In 1858, a ¾-mile line composed of two 2¼-in. tubes was built for the same company by Mr. C. F. Varley, but it was operated by compressed air. This system is used in many European cities, mainly with very small tubes. The pneumatic mail transmission systems employed in this country, however, use 6-in. and 8-in. tubes, and are operated by compressed air at a pressure of from 7 to 10 lbs. per sq. in. The pressure system was said to give better results than the earlier vacuum system. On the other hand, an advantage claimed for the latter is that there is no tendency to the collection of moisture, such as occurs where compressed air is used. This moisture may cause trouble, especially if it freezes in the tubes. Such freezing may occur where pipes in cold districts are laid near the surface of the ground or in exposed places. The lines in this country are operated mainly under the Batcheller and Stoddart patents.

A system of mail transmission in large pneumatic tubes was introduced in London in [illegible], for the purpose of connecting railway stat[illegible] with the post offices. The first line was 1,8[illegible] ft. long, and had a single tube of D section, 32 × [illegible]

ins., w... a flat floor. In 1872, a line 2¾ miles long w... built. It had two tubes 4½ ft. wide and 4 ... high, built partly of brick and partly of cas... on. The cars ran on rails and were about ... ft. long. They made the trip in 12 minute... A 22-ft. fan was used for the longer line, f...g air into one tube and exhausting it from the other. The vacuum was about 10 ins. of wat... or equal to 6 oz. per sq. in. The system w... found to be too slow and was abandoned. ... many respects, however, it resembled the 2... tube system now proposed by Mr. Stoetz... of Chicago, and already mentioned.

PROFESSIONAL ETHICS FOR THE MINING ENGINEER.*

By John Hays Hammond,† M. Am. Inst. M. E.

The question has been often discussed among engineers, whether it is professionally proper to make a report for the seller of a mining property. Such practice has been sometimes condemned; but a little reflection will show that the condemnation is not warranted. For it is neither wrong nor unreasonable that the owner of a mineral property should desire to present such a statement of its nature and probable value as will secure the attention of possible purchasers; or that he should secure for such a purpose the assistance of one who knows how to make such a statement intelligently and in scientific language—that is, the language which will convey a definite meaning to those who know it—or that he should pay such an assistant for his skill and labor.

It goes without saying that no expert in such a case, or in any other case, may suppress or misstate facts, or disguise or withhold his honest opinion, in a statement to which he lends his name.

Yet, this being understood, it still remains true that a "vendor's report" is not advice to anybody to buy, at a stated price, but only a description of the property—usually without any mention of the price at which it would be to the purchaser a profitable bargain. There is nothing dishonorable or unprofessional in honestly making, for the owner of the property, such a description. But there is often danger that it may be afterward used as if it were advice offered to a purchaser. In any such report, therefore, the fact that it was made for the owner, or vendor, or his representatives, should be clearly stated beyond all misunderstanding, for the protection of both the author and the reader. This precaution being observed, I see no valid objection to the writing of such a report by a mining engineer.

Nevertheless, it is an undesirable kind of work, particularly for young mining engineers, whose reputation for integrity and judgment, not yet established by long practice, may be, justly or unjustly, placed in jeopardy by any such expression of their opinions, and may be destroyed, in public esteem, by the failure of any mining scheme with which their names have been thus associated.

In their own interest, they should accept such engagements with caution, and protect themselves with vigilance against illegitimate or misleading use of their statements. In short, they take, in such cases, a risk which older engineers, backed by a reputation already established, could better afford to take.

CONTINGENT FEES.

In this connection arises the question of the acceptance of contingent fees. It seems to me that an expert of established and unimpeachable reputation is perfectly justified in recommending the purchase of a property and accepting compensation from the promoters, provided, first and without qualification, that full publicity be given to the nature of his connection with the enterprise; and secondly, that his compensation be contingent, not upon the successful sale of the property, but upon the subsequent success of the undertaking.

In other words, an expert who makes a favorable report upon a mining property for which he is to receive payment in money if the property be sold on his report, must needs have an unparalleled reputation for integrity to endure that revelation of this situation, which he cannot without dishonor withhold. But one who frankly avows that he is to be paid in the stock of the projected company and, therefore, as an investor of time, skill and labor, is on the same footing as the investors of money, occupies a much less vulnerable position. In either case, and in any case, there is no safety—and, I may almost add, no honor—outside of the frank and full publication of all such circumstances as might be afterward called in question, criticized or condemned.

This is the expert's Golden Rule: "Tell unto others, now, whatsoever you would not have them tell on you—with unjust misunderstanding and scandalous comment—hereafter!"

COMMISSIONS.

Another question involved in the relations of a mining engineer to his employer concerns the acceptance of commissions from the sellers of machinery, supplies, etc., the purchase of which he has made as agent, or recommended as adviser.

From the standpoint of the engineer, acting as a purchasing agent or adviser, the case seems to me as clear in the court of honor as it would be in a court of law. He cannot honorably accept a commission from the seller, while he is the agent of the buyer. If the custom of the trade permits the giving of such a commission, but not its deduction from the face of the bill rendered, he may, of course, honorably accept it and pay it over to his own employer—that being the only way in which he could secure the minimum net price in his employer's interest. But even in that event, he should place his honor beyond suspicion—as, for instance, by demanding the commission in a check to his own order, and indorsing the same check to the order of his employer.

It seems almost superfluous to insist upon the duty of maintaining a spirit of loyalty toward employers. Yet this spirit is by no means as prevalent as a sense of honor, or even of enlightened self-interest, would demand. Loyalty to a corporation should be as unquestionable as to an individual. In neither case should it be sacrificed to feelings of personal resentment or disapproval. If one cannot "stand for" the policies or practices of one's employer, the straightforward course is to seek employment elsewhere.

There are two special spheres in which the mining engineer, like the members of other technical professions, maintains a double relation.

One of these is that in which, being himself an employee, he exercises the employer's authority over other employes. In such a position, while it is his duty to protect vigilantly his employer's rights and interests, he should realize that he cannot do this more effectively than by invariable justice, good-nature, respect and sympathy toward his own subordinates. Nothing contributes more to the success of an enterprise than the mutual exercise of these feelings between workmen and superintendents or managers. It is "team-work" that wins in industrial undertakings, as well as in the athletic field. And in these days especially, it is the cultivation of an esprit de corps, based upon truly friendly personal relations, which offers the best protection against the schemes of mischief-makers and demagogues.

The other double relation to which I have alluded is that which is occupied by an expert witness in a court of law. In this case, he is theoretically amicus curiae, a friend of the court, giving under oath his assistance in the recognition and interpretation of the facts of the case; and, for this reason, he is permitted to do what no ordinary witness can do, namely, to give opinions as well as personally observed facts, and to support these opinions by hearsay evidence or scientific authority and argument, not otherwise admissible as testimony. Yet, on the other hand, he is retained and paid by one of the litigant parties; and he would not appear in court at all, were it not reasonably certain beforehand that his testimony would support the theory and benefit the cause of his clients.

The ethics of this situation may be more clearly perceived, if we consider that, first and foremost, the expert witness must remember the obligation of his oath. He has not the same latitude as the attorney, whose official duty is to present a client's case, without declaring his private opinion about it. Consequently, the expert witness should be thoroughly convinced beforehand of the justice and truth of the cause or the theory in support of which he appears. Such a conviction ought to be based upon a careful and exhaustive previous examination of the case; and no expert should agree to testify in any case until such an examination has established his opinion, and qualified him to defend.

A more simple and congenial, yet more heavily responsible, relation is that which the mining engineer may be called to assume toward the public, as the responsible indorser of a proposed undertaking. In consideration of the confidence which he invokes and expects, notwithstanding the fact that he has been paid by interested parties, he assumes a sacred trust, obligating him to safeguard the interests of a wider and more important clientele. The investor has not the time, and perhaps not the technical knowledge required for the thorough study of a prospectus. He risks his money upon his belief in the ability and integrity of the engineer, who is, therefore, bound in prudence and in honor to be especially careful that his indorsement be clear and precise, without mental reservation or opportunity for misunderstanding. This caution applies particularly to what are called "gilt-edge" investments, that is, to enterprises so promising and so thoroughly investigated beforehand as to warrant their recommendation, on the terms stated, to the general public—that is, to unknown and probably unskilled clients. There are numerous instances in which the engineer has to give advice on speculative, though honest and legitimate, undertakings, such as the development of mining prospects, which should be confined to those who are willing, and can afford, to take greater risks in the hope of larger profits, than pertain to the "gilt-edge" class of mining investments.

In connection with the class of advisory reports last named, it is good policy for the expert adviser to seek to acquire a special clientage among mining investors who will not be led to judge him by the results of a single case, but, knowing the wisdom and the successful outcome of his recommendations in other cases, will not condemn him when he turns out to have been mistaken. For such a disappointment, sooner or later, is inevitable, since no engineer, however able and careful, is infallible.

In my opinion, a mining engineer engaged in such consulting practice should aim to become himself a capitalist, and a purchaser and developer of mining properties. Should he acquire business experience he might become avowedly a promoter, in a high and worthy sense of that term, and thus assist in driving out the unscrupulous promoters who are really parasites. According to my observation, the swindling in mining enterprises is done mostly by laymen, and not by responsible professional engineers or practical miners. The practical miner, indeed is, in many instances, himself the victim of the unscrupulous promoter.

The engineer should use the greatest circumspection to prevent the use of his name in support of enterprises of which he has but a superficial knowledge. He may be quite willing to "take the chances," and invest some of his own money in a scheme which he would not be willing to take the responsibility of recommending to another party, dependent upon his judgment as a guide. But even such a private investment of his own money should often be avoided, lest his connection with the scheme as a simple stockholder should be construed as implying his deliberate indorsement of it as an expert.

It often happens that an expert who has won deserved reputation and public confidence is called to give advice concerning a district with which he is not personally acquainted. In such a case, his honest off-hand judgment, based upon general knowledge and upon experience elsewhere, might mislead both himself and others. Yet it is practically impossible for an expert, visiting a given property or district for the first time, and, of course, known to all as the possible "advance agent" of capital, to get at the unfavorable conditions which it is everybody's interest to hide. I would earnestly recommend, in such cases, the engagement by the examining expert, at his own selection and cost, and without notice to any other party, of a local expert assistant, familiar with the conditions and history of the property concerned and of the district in which it lies—in other words, with those facts which a visitor cannot easily discover.

*Extracts from an address delivered at the Chattanooga meeting of the American Institute of Mining Engineers.

†President, American Institute of Mining Engineers, 71 Broadway, New York City.

THE SELF-FIRE-INSURANCE-FUND SURPLUS of the Philadelphia Rapid Transit Co. accumulated to the extent of more than $800,000 in the six years ending June 30, 1908. The fund is built up by monthly payments from the company's receipts and investment income.

A STATE FORESTER FOR VERMONT was recommended in the valedictory message of Mr. Fletcher D. Proctor, until recently Governor of Vermont. He stated that 60% of the area of the state was in forest or wild land. The fact that large tracts of former pasture and even tilled land are growing up to trees has been a source of regret in the past, and schemes for the reclamation of these areas have been discussed. But these lands can never successfully compete agriculturally with more productive areas. They are suited to forestation and if wisely developed to that end will, with increasing value of timber, make important additions to the wealth of the state. The beginnings of forestry work already made in Vermont, with recommendations for the future, were thus stated by Mr. Prouty:

> Vermont has already begun to recognize her duty in this regard. In 1904 the Legislature provided that the Governor should designate one of the members of the board of agriculture to act as a forestry commissioner and that the first selectman of each town should take measures to control and extinguish forest fires. It also exempted from taxation for ten years uncultivated lands planted with timber or forest trees under certain conditions. The Legislature of 1906 appropriated $500 annually for five years for the purpose of aiding in the establishment and maintenance of a nursery for the propagation of forest seedlings of useful varieties at the Vermont Agricultural Experiment Station. The commission on taxation in their report recommended changes in the taxation of timber lands for the purpose of encouraging their cultivation and preservation.
>
> All this has been in the right direction, but it does not go far enough. Vermont should have a distinct forest policy of her own. That this may be successfully inaugurated and carried on we should have a state forester educated and trained along the most advanced and approved lines, who shall give his entire time to the study of forest conditions as they exist in Vermont, with a view to their practical and permanent improvement. This policy has been adopted by many of the states, and it is most successfully pursued by the national government in the territories and national preserves under its jurisdiction. Such a forester should carry on a publicity and educational work, freely advise with individual owners, supervise our forest fire laws, which ought to be strengthened and made more efficient, eventually take charge of the state nurseries for forest seedlings, and in a general way formulate and conduct a policy so vital to the true prosperity of the state. While this will entail some expense, I believe the state can undertake no work nor assume any equivalent expense that would yield to her people greater returns than an advanced forestry policy wisely and progressively conducted.

A DISASTROUS GRAIN ELEVATOR EXPLOSION.

A grain elevator at Richford, Vt., was destroyed by fire on Oct. 7 following a violent explosion which occurred about 4.30 p. m. The fire spread very rapidly; 15 of the elevator employees were killed, and two women who were walking on the railway track west of the building and entirely outside of it were so badly burned that they died soon afterward. A large warehouse and the boiler-and-engine house adjoining the elevator, were destroyed and many freight cars were burned.

At our request the circumstances in connection with the disaster have been investigated by an engineer on the ground and it seems to be certain that an extensive dust explosion occurred, possibly initiated by a preliminary explosion of gas or by a fire due to spontaneous combustion.

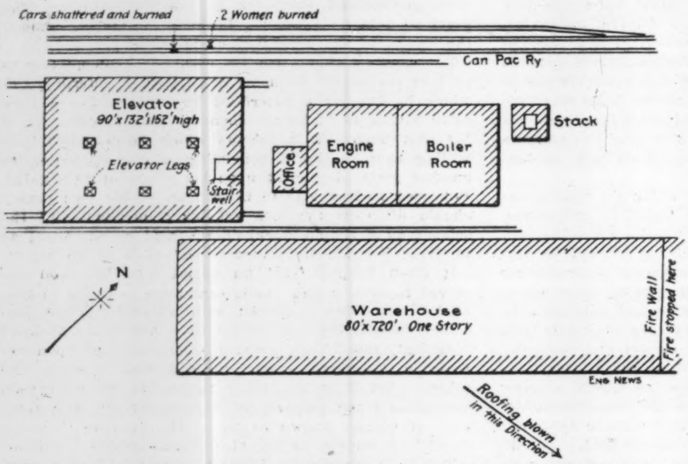


FIG. 1. SKETCH PLAN OF RICHFORD ELEVATOR, RICHFORD, VT.

The plan (Fig. 1) herewith will serve to explain the conditions. The elevator, of 600,000 bushels capacity, stood alongside the Canadian Pacific Ry. tracks and was served by tracks on either side of the building and two additional tracks passing through the building. North of the elevator, along the tracks, was a one-story brick boiler-and-engine house, with office addition. East of this, on the side away from the tracks, was a long one-story storehouse. The elevator had 80 bins, and was 90 ft. high from the ground to bin floor and 152 ft. from ground to roof of superstructure. It was of the usual wooden-bin construction, covered with corrugated iron on the outside. The elevator was about 17 years old, but the storehouse was less than half as old. In one corner of the second floor of the elevator was a small milling plant, comprising two sets of rolls and two sets of stones.

The elevator was nearly full at the time of the accident, most of the contents being new grain. Some weeks ago the building was thoroughly cleaned, during a temporary shutdown, and it has had several partial cleanings since then. Sweepings were kept in a small room in the southwest end of the building and removed every few days. It is said that a few of the bins contained old grain which recently showed some heating. Nothing is known that would show what connection there may have been between either this heating or the dust conditions and the explosion. Some 30 men were employed in and about the elevator.

Eye witnesses of the accident agree in speaking of a double explosion, a small one followed by a very severe one. Molasses was being pumped from a tank outside the building near the southerly end, and some cars were being shifted east of the building at the time. Men working in this neighborhood within 50 to 150 ft. from the building noticed that there was no fire or smoke attendant on the explosion, but within half a minute afterward flames were coming through the roof and smoke was rolling out of the windows. Some cars standing on the track west of the elevator were shattered and thrown off the rails, and soon afterward caught fire. These cars may be seen afire in Fig. 3. Two women near by were fatally burned, having probably been thrown down and stunned by the explosion. No one farther than 100 ft. from the building was knocked down or injured by the explosion.

The roofing of the elevator—wood and corrugated steel, was scattered over a large area to the northeast, in small pieces (see Fig. 4, showing material gathered within a 100-ft. circle nearly half a mile away). Most of the wreckage went to the northeast, and in other directions little was thrown more than 100 ft.

The boiler and engine house was wrecked, except the northerly end (Fig. 4). The warehouse was burned down as far as a firewall at about the middle of its length.

The elevator was owned by the Canadian Pacific Ry. and was rented to the Quaker Oats Co.

WHAT EUROPE IS DOING WITH WATERWAYS.*

By J. A. OCKERSON, M. Am. Soc. C. E.†

I had the honor of appearing as an official delegate of the United States at the Eleventh International Congress of Navigation held at St. Petersburg last June. In addition to a paper on the protection of low-lands from floods, which had been assigned to me, a paper on the proposed Lakes-to-the-Gulf Waterway was presented at the request of the Russian engineers.

At the close of the Congress, three months were devoted to an examination of the principal waterways and harbors of Europe. A tour was made through the Russian waterways from the Baltic Sea to the Volga River and continued to the Vistula, Dánube, Rhine and Elbe rivers. It covered also the harbors, canals and dikes of Germany, Holland and Belgium, and closed with the harbors and canals of Great Britain.

In each case the examinations were made under official auspices and in company with the engineers conducting the work, and there is every reason to believe that the information gathered is essentially correct.

The Mississippi River Commission was particularly desirous of ascertaining what was being done in the way of construction and operation of dredging plants of great capacity, and particular attention was paid to this subject.

It was my good fortune to be intimately connected for some years with investigations relating to the improvement of the Mississippi River, and I have long felt that we as a people have neglected one of our most valuable assets in failing to develop a great transportation highway, a trunk line waterway, along the route nature has marked out from the Great Lakes to the Gulf of Mexico, stretching 1,625 miles through the heart of the Mississippi Valley.

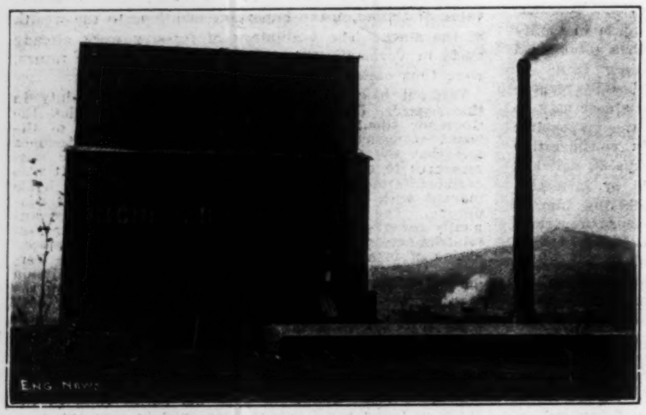
I have never had any doubt about the possibility of improving the Mississippi River to any extent that the demands of commerce might dictate. If there had been any such doubt lingering in my mind it would have been entirely dispelled by what I saw during my recent investigations of European waterways. Nature has not done for them what it has for us. The Mississippi is built on a lavish scale wholly wanting in the greatest of their streams, and yet they have developed and improved them until they have become most important factors in economical transportation.

Some would have us believe that waterway transportation has become obsolete, but when we see all of the countries of Europe actively engaged in the development of their rivers and canals, and furthermore see these waterways crowded with traffic and the craft employed thereon increasing in number and size year by year, there can be but one conclusion, and that is, that waterways are essential to their well being.

One waterway visited has been enlarged and deepened four times to keep pace with the increasing demands of commerce, until now it has a depth of 27 ft. The Kaiser Wilhelm Canal, but a few years old, has already been found inadequate, and a project has been adopted to double the width and increase the depth to 40 ft. at a cost of $1,000,000 per mile. Berlin is ambitious to be a seaport, and a project for a maritime canal from the Baltic Sea is under way. Brussels, Ghent and Bruges are engaged on similar projects.

Russia has an elaborate project in view for enlarging the waterway from the Baltic Sea to the Caspian, a project not unlike our own from the Lakes to the Gulf. Germany, France and Austria are devoting their energies to the construction of canals and the improvement of their streams. Many new projects involving large expenditures are receiving serious consideration.

Great Britain has a Royal Commission ap-



FIGS. 2 AND 3. THE RICHFORD ELEVATOR BEFORE THE EXPLOSION AND DURING THE FIRE.

*Abstract of a paper read at the Lakes-to-the-Gulf Deep Waterway Convention, held in Chicago, Oct. 7 to 9.
†Consulting Engineer and Member of the Mississippi River Commission, 1301 Liggett Building, St. Louis, Mo.

pointed for the purpose of ascertaining the feasibility of developing an elaborate system of waterways which will involve an expenditure larger than the total amount expended on our rivers and harbors up to date.

Canada has expended $600,000 in surveys and examinations looking to the development of a waterway with a depth of 22 ft. from Lake Huron to Montreal, and an expenditure of $150,000,000 is not regarded as too high a price to pay for it. In the meantime their commercial bodies are clamoring for an increase in the depth of the Welland Canal to 21 ft.

Throughout an extended tour of the Russian waterways from the Baltic Sea to the Volga River, a continuous stream of traffic was encountered. At the port of Rybinsk, loaded barges were anchored in midstream ten abreast for a long distance, waiting for an opportunity to discharge their cargo. It was estimated that there were about 1,000 barges in that port alone. The cargoes consisted chiefly of grain, timber and petroleum.

In the river Lek and its connecting canal to Amsterdam, the traffic amounts to over 60,000 vessels of all kinds per annum. In a few hours' ride on the Danube River, over a hundred separate craft were passed. The Rhine and Elbe have a large amount of traffic, and the ports of Rotterdam and Hamburg, where the sea-going traffic is met with, are filled with hundreds of river craft exchanging their cargoes for return loads from distant ports.

The motor boat of light draft is coming into use, bringing cargoes out of the smaller streams to the larger craft of the rivers, thus extending the benefits of navigation to points remote from the larger streams and becoming feeders thereof.

We are told that the traffic from the Lakes to the Gulf would practically move in one direction only, and boats must needs return without a cargo, hence it would not become a satisfactory freight carrier. That is also essentially true of railways and steamships as well. Freight trains devoted to coal, lumber, grain and ores must necessarily return empty. Steamship freighters come to our shores in ballast to secure return cargoes, and even the great express steamers have small passenger lists one way or the other.

However desirable it might be to move full loads in both directions, the opposite condition is almost universal and does not apply with any special force to this project. On the contrary, inland waterways reaching the seaboard where materials destined to interior points are to be distributed, fare better in this respect than any other modes of transportation.

The Manchester Ship Canal has been cited as a waterway failure. It is true that the shareholders have received no dividends on their stock. But the business of the city of Manchester has

FIG. 4. WRECKAGE OF ELEVATOR AND ENGINE-HOUSE, LOOKING NORTH.

been so materially benefited that the money expended in the construction of the canal is generally regarded as a good investment, showing indirectly ample returns for the money expended.

The greatest rivers in France, Germany and the adjacent countries are small when compared with the Mississippi, yet they have done wonders in their development. They have compelled them to flow in fixed channels along routes established by the engineers. Their floods are confined and controlled between fixed barriers so well constructed that they practically never break. Their banks are so well paved that they contribute little or nothing to the load of silt brought down by the smaller tributaries. Their facilities for transfer of freight are so well designed and ample that interchange of traffic is accomplished in an expeditious and economical manner. Their limited supply of water under low stage conditions has been conserved and made the most of.

THE PENNSYLVANIA CONDITIONS FOR APPROVING PLANS FOR MUNICIPAL SEWERAGE AND SEWAGE DISPOSAL WORKS.

In approving the plans for a sewerage and sewage-disposal system for Allentown, Pa., Dr. Samuel G. Dixon, State Commissioner of Health, attached some lengthy memoranda, a brief review of which may interest some of our readers. It appears, from an abstract of the memoranda published in the Allentown "Morning Call" of Sept. 18, that the document consisted of a somewhat extensive review of the proposed sewerage scheme. Attention was called to the relation of sewage disposal to the water-supply of some of the municipalities of the state, evidently including the water-supply of Allentown itself.

The proposed sewers are to be on the separate plan and to serve ultimately a population of 125,000. The laterals are to be built quite generally in alleys, and "in other cases where streets are now permanently paved two sewers are designed, one on either side near the curb line." There will be four intercepting sewers. Three of these will lead to a pumping station, where the total lift will be about 70 ft. and where two 4,000,000-gal. and one 8,000,000-gal. centrifugal pumps, direct-connected to steam engines, will be installed.

The sewage will be screened and will pass through settling or septic tanks, percolating filters, and a resettling basin. The sewage will be distributed over the filters by means of nozzle sprinklers.

After outlining the proposed works and calling attention to the fact that the sewage from Allentown might within four hours find its way into the water-supply of South Bethlehem, the document concludes with a statement of conditions of approval of the plans, as follows:

In view of the foregoing considerations, it has been unanimously agreed by the Governor, Attorney-General and the Commissioner of Health that the interests of the public health will be subserved by granting a permit for the installation of the proposed sanitary sewer system and sewage purification works and I do hereby and herein grant a permit therefor under the following condition and stipulations:

(1) That all storm and roof water shall be excluded from the sewer system and special care shall be taken to obtain water-tight sewer lines. At the close of each season's work a plan shall be submitted and filed in the office of the Commissioner of health, showing all sewers laid during the year, together with any other information in connection therewith that may be required, in order that there shall be on file in said office an accurate plan of the existing sewer system of the city with reliable information in reference to its use.

(2) No pathogenic material from any laboratory shall be discharged into the sewer system. The proper authorities shall cause these wastes to be destroyed on the premises.

(3) The city shall enforce such reasonable measures as may be necessary to bring about at the earliest practicable moment the discontinuance of the discharge of all sewage and trade wastes into storm drains or natural watercourses or into the waters of the State, on or below the surface of the ground, within the limits of the city. The sewer system and sewage-disposal works herein approved shall be built or construction work thereon shall be started on or before the close of the season of 1909. It would be wise for the city to have its experts examine into and report upon the trade wastes drainage problem.

(4) Detail plans for the proper and sanitary disposal of the septic-tank and settling-basin sludge and drainage shall be prepared and submitted to the Commissioner of Health for approval before the disposal works shall be put in operation.

(5) Detail plans of the entire sewage-disposal plant and the low-level pumping-station plant as built when the work herein approved is completed, shall be prepared by the city and filed in the office of the Commissioner of Health without delay.

(6) Within three months from the date of any request which the Commissioner of Health may make therefor, the city shall prepare and submit plans and a report on

Fig. 5. Parts of Roofing Half a Mile from the Station.

additional units to the sewage-purification works of a sufficient total capacity to accomplish the purification of all of the city sewage discharged into the sewer system, together with that which may be reasonably expected to be discharged by said system in the near future.

(7) The city shall expedite the work of intercepting the sewage now going into the Little Lehigh Creek within the city limits above the emergency water-works intake and the private intake at the steel and wire plant, and is hereby permitted, if it be necessary, to make a temporary outlet for said sewage into the creek below these points, pending the construction of the sewage pumping station and outfit.

(8) Daily records of the operation of the entire sewage-disposal works, beginning at the pumping station, shall be kept by the city in form satisfactory to the Commissioner of Health, and copies thereof shall be filed in said Commissioner's office. The city shall cause to have made frequent analyses of the crude sewage and of effluents at various stages of the process of treatment, sufficient to show the efficiency of the plant and to enable deductions to be made therefrom as to management and operation. The plant shall be operated for one year under the responsible supervision of the experts who designed it, beginning at the start of the operation, or if not by these experts, then by others equally competent to perform such service. The results of all tests shall be given to the Commissioner of Health, who may make rules and regulations governing the operation of the plant in so far as these may affect the quality of the effluent discharged into the water of the creek.

(9) If, at any time, in the opinion of the Commissioner of Health, the sewer system or the sewage-disposal works or any part thereof has become a menace to public health, then such remedial measures shall be adopted as the Commissioner of Health may approve or advise.

This permit, before being operative, shall be recorded in the office of the Recorder of Deeds for Lehigh County.

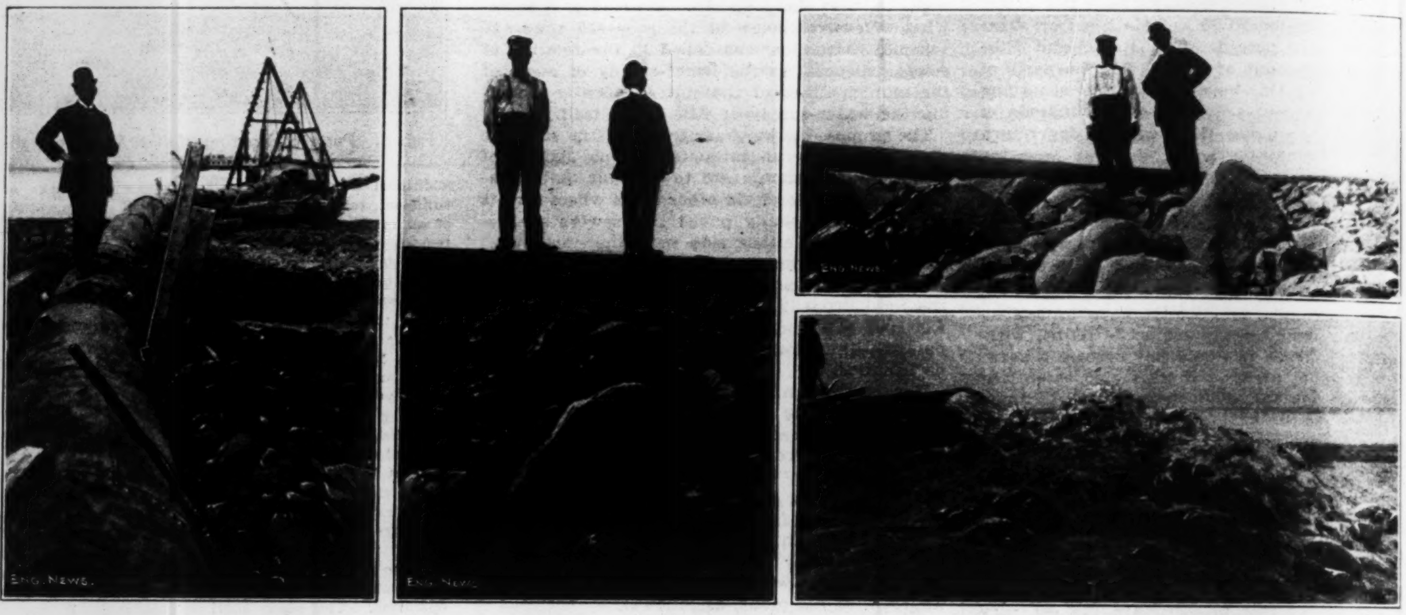
POOLING FREIGHT CARS.—"There are a great many people who agree that, theoretically, the pooling of equipment is a good thing in times of car shortage. There are a great many other people who practically go in for pooling cars without admitting it. Whenever the car of an eastern road is used for a westbound shipment—and that has happened more than once within my observation—the agent who sends the eastern car to the West is pooling cars. Whenever that happens, and it has happened with some frequency, it is an acknowledgment on the part of the agent that pooling cars is the proper thing, and whenever the superintendent does not call the agent down, the superintendent agrees that the pooling of cars is the proper thing. * * * When it comes down to getting advocates for your pooling scheme, there is not really any one that wants it. It will only be when the 'creditor roads' find out that about the only thing they can get is some pool understanding that will ensure them an equal number of cars to those that are owned by them—when the creditor roads find out that is the best they can do, then we will get support for the pooling of cars. And all our committee has been able to do so far has been to show by its statistics and to show by its report that, in times of shortage of cars, cars are pooled."—Arthur Hale on "Car Efficiency," Western Railway Club, Sept. 15, 1908.

DREDGING CLAY IN CHUNKS.

The accompanying photographs were recently taken on the dump at Lincoln Park, Chicago, where a 30-in. hydraulic dredge the "Francis T. Simmons," is discharging material dug from the bed of the lake. This dredge and its work during the season of 1907 were described in our issue of Feb. 27 last (p. 221). The photographs are notable as showing what large and solid pieces of material it is possible to dig and discharge with a hydraulic dredge. Some of the chunks of clay shown in the photographs are 20 ins. in diameter and 4 to 5 ft. long. When the dredge is making a heavy cut these huge shavings issue from the end of the discharge pipe in an almost continuous stream. The discharge pipe is at times 2,000 to 3,000 ft. long.

As stated in our previous article, this dredge was built by the Atlantic Equipment Co. from designs by Mr. A. W. Robinson, M. Am. Soc. C. E., of Montreal, and is fitted with a new type of rotary cutter for heavy clay soils.

Recent reports from the "J. Israel Tarte," another of Mr. Robinson's dredges of this type, continue to show good results. This dredge is engaged on the River St. Lawrence Ship Channel and was described in Engineering News of July 28, 1904. It has now been seven years in service. From May 11, 1908, when the dredge began this season's work, to Aug. 29, a period of 16 weeks, the quantity dredged was 1,702,000 cu. yds. of soft blue clay, measured in place, dredged from a depth of 34 ft. and delivered 2,000 ft. distant. The best single 24 hours' work was upwards of 33,000 cu. yds.



DISCHARGING CLAY FROM THE HYDRAULIC DREDGE "J. FRANCIS SIMMONS" AT LINCOLN PARK, CHICAGO.

REPORTS ON DETAILS AND MATERIALS IN RAILWAY PILE-AND-FRAME TRESTLE BRIDGES.*

On Jan. 25 a circular letter was sent to 100 members of the association, as follows:

1. Do you use any device to fasten the rail to the tie other than the common track spike, and with what success?
2. Do you use any device to prevent rails creeping, and with what success?
3. Do you use a metal guard rail of any kind, if so please describe?
4. What do you consider the best span length to use?
5. What do you consider the best kind and size of timber to use for the following members: Caps, stringers, ties and piles?
6. What do you find to be the average life of the above members with or without preservative treatment?
7. Have you used any concrete piles, if so please give method of making and driving?

From these letters 27 replies were received and the answers to the questions tabulated. The chairman thinks that printing several of the replies, together with the plans sent in, and setting down his personal conclusions wherever he was able to draw them, will bring out an interesting discussion.

Question 1.—There were 27 replies; 22 of the roads use nothing but the spike, and 5 roads use tie plates in connection with the spike. As on all bridges of this class, the ties are spaced close together, and generally are of selected timber, and as the tie plates tend to develop a split in the ties, their use does not seem to be the best practice. The best practice seems to be that of spiking the rail directly on the ties, and especially avoid spiking through the holes in the angle bars. It would undoubtedly be of great benefit if some of the members of this association would experiment with some other form of fastening than the spike, such as the lag screws, or bolts, used abroad, and which are supposed to be far less destructive to the tie.

Question 2.—There were 27 replies; 23 of these report that no anti-rail creeping device is in use on their roads. One road uses blocks between the ties and spikes the angle bars to the ties and to the blocks with good success; one road uses the L. & S. rail anchors with good results; one road slants the spikes in the fish plates.

From the replies it would appear to be the best practice not to attempt to hold the track from creeping on these structures, but if the movement is enough to warrant it, to use some device to prevent it on the approaches to the structure.

Question 3.—There were 27 answers; nine of the roads reporting use no metal guard rails on this class of structure; 18 of the roads use T-rails, usually the old track rails and somewhat lighter than the traffic rails. These rails are spiked to the ties at a distance varying from 6 to 10 ins. on the various roads. From the replies it would seem to be the best practice to use a metal guard rail; if no specially designed rail is used, old rails spiked inside the traffic rails, and terminating in an old frog point in the center of the track against approaching trains may be used. This point should be placed far enough from the end of the bridge so that the rails will not converge too rapidly. On the approach in the direction of traffic the point may be omitted and the rails terminate a short distance from the end of the bridge. On single track roads there should be a point on each approach.

Question 4.—There were 25 replies, the span length used varying from 12 to 16 ft., with an average of 13 ft. 6 ins.

Questions 5-6 will be taken up in separate parts.

Caps: The sizes used are as follows:
12 × 12 ins. × 14 ft.; 12 × 12 ins. × 20 ft.; 12 × 14 ins. × 12 ft.; 12 × 14 ins. × 14 ft.; 12 × 18 ins. × 16 ft.; 14 × 14 ins. × 12 ft.; 14 × 14 ins. × 14 ft.; 14 × 14 ins. × 16 ft.

One road uses a double cap consisting of two pieces, 6 × 12 ins., with a 6 × 16-in. rider.

The material used is long-leaf pine on 13 roads; Douglas fir on 9 roads; oak on 2 roads; white pine on 1 road.

The average life is as follows:
Long-leaf pine, from 12 roads, 10 years.
Douglas fir, from 8 roads, 10 years.
White or burr oak, from 2 roads, 11 years.

One road uses galvanized iron covers over a long-leaf pine cap and reports a life of 8 to 10 years. As this is a southern road where the life is usually shorter, this may be an advantage.

Stringers: The sizes used are as follows:
7 × 15 ins.; 7½ × 15 ins; 7 × 16 ins.; 8 × 16 ins.; 8 × 17 ins.; 8 × 18 ins.; 9 × 14 ins.; 9 × 16 ins.; 9 × 18 ins.; 10 × 16 ins.; 12 × 14 ins.; 12 × 16 ins.

Nearly all the roads reporting agree on using continuous stringers over two spans.

The material used is long-leaf pin[illegible] on 13 roads; Douglas fir on 10 roads; white oak o[illegible] road; white pine on 1 road.

The average life is as follows:
Long-leaf pine, average from 13 ro[illegible] 10 years.
Douglas fir, average from 10 roads [illegible] years.
White oak, average from 1 road, 10 [illegible]
White pine with iron cover, 1 road [illegible] years.

Ties: The sizes used are as follows:
6 × 8 ins. × 9 ft.; 6 × 8 ins. × 12 ft[illegible] 8 ins.; × 10 ft.; 7 × 9 ins. × 9 ft.; 8 × 8 ins. × 9 [illegible] × 8 ins. × 10 ft.; 8 × 10 ins. × 11 ft.; 8 × 8 ins. [illegible] ft.

The material used is long-leaf pin[illegible] 10 roads; Douglas fir on 5 roads; white oak on [illegible]ds.

The average life is as follows:
Long-leaf pine, average from 10 ro[illegible] years.
Douglas fir, average from 4 roads, [illegible]ars.
White oak, average from 4 roads, [illegible]ars.

Piles:
The material used is white or burr o[illegible] 12 roads; white cedar on 7 roads; creosoted pin[illegible] 3 roads; red cedar on 2 roads.

The average life is as follows:
White or burr oak, average of 10 r[illegible] 10 years.
White cedar, average of 6 roads, 1[illegible]rs.
Red cedar, average of 2 roads, 12 y[illegible]
Treated pine, average of 2 roads, 14 [illegible]

Conclusion to Question 5-6: The two spe[illegible] of timber in general use for caps, stringers and tie[illegible] Douglas fir and long-leaf pine.
stringers and ties are Douglas fir and long[illegible] pine.

The replies do not indicate that there is [illegible] great difference in the behavior of the two in these st[illegible]tures and that, therefore, each road should use the one that can be secured at the least cost. The other species of timber used for these members do not seem to have advantages enough to overcome their cost and scarceness; the possible exception being the use of white or burr oak for caps, due to the high resistance to crushing. It is probable that good results can be obtained by the use of the cheaper pines by using some preservative process.

It would doubtless be of great advantage if the designers of these bridges could get together and adopt uniform sizes and lengths for these members. If that were done these timbers could be cut in large quantities, and treating plants could season and treat them with the certainty of a demand for them. Possibly each class of track adopted by the maintenance-of-way association could have a separate plan.

For piling the better species are becoming too scarce to supply the demand, and as they are of extremely slow growth, use will have to be made of the cheaper grades treated.

Question 7.—Replies were received from 26 roads, none of which have ever used a concrete pile in the class of structures under discussion.

*Abstract of Committee Report to the Association of Railway Superintendents of Bridges and Buildings, Washington, D. C., Oct. 20-22, 1908. Mr. H. M. Trippe, C. & N. W. Ry., Chairman.

INDUSTRIAL MOTOR VEHICLES, in an extensive, competitive French test described in the Monthly Consular and Trade Reports for September, showed a decrease of 53% in consumption of gasoline per ton-mile compared with the results of a similar test performed in 1907. The test of 1908 was completed May 31. The entries comprised motor omnibuses and touring cars carrying six or more passengers besides a chauffeur and conductor, and cars for the transportation of merchandise. Sixty per cent. of all the vehicles entered made the entire tour, which occupied 27 days and covered a distance of 2,175 miles, and finished in good working order. The total general average consumption of gasoline per ton-mile was 0.074 qts. against 0.157 qts. in the similar test of 1907.

THE CONTROL OF TROPICAL DISEASE IN THE ISTHMIAN CANAL ZONE.

In all the discussions over the Panama Canal enterprise prior to the actual undertaking of the work great weight was given to the evil effects of tropical disease upon the working force. It was a stock argument of those who favored the Nicaragua route that health conditions there would be more favorable. One man wanted to put the whole canal route at Panama under water as the only sure way to prevent disease-spreading mosquitoes from propagating, and he drew terrible pictures of the havoc disease would make in the working force if any other plan than his was followed.

Looking back now, it is probable that the dangers and difficulties were not over-estimated; but what was lacking was allowance for what modern sanitation and preventive measures have made possible in the treatment of tropical disease. The results attained on the Isthmus are nothing short of marvelous. They are an illustration on a large scale of what it is going to be possible to do in the future to make life in the tropics reasonably safe. There has not been a case of yellow fever or bubonic plague on the Isthmus for two years. The death rate among the colored population has been reduced from 71.60 per thousand in 1905 to 12.14. During the month of August, out of 8,175 white Americans in the Canal Zone, of whom 2,869 were women and children, there were but two deaths, and both those were the result of accident. The deaths from malaria in a total force of 29,000 men in August, 1906, were more than three times as many as in a force of 44,000 men in August, 1908.

This reduction in malaria has been effected by increasing vigilance and thoroughness in the work of mosquito extermination. An example of how they work is carried on is given in the following, taken from the "Canal Record" of Oct. 7:

During the latter part of June, the malaria rate at Corozal suddenly took a jump upward. No further indication was needed to assure the Department of Sanitation that the anopheles mosquito had found a new breeding place in that vicinity, undiscovered by the district inspector.

Unable to account for the rise, at his request a special inspector was sent to his assistance. The Chief Sanitary Inspector, not being satisfied with the report, sent out a second inspector, and finally a third. The recommendations of all were carried out, and the rate fell steadily, but not to the normal, and the returns for each week were regarded with dissatisfaction.

About the middle of August, the rate suddenly shot up higher than ever. Two inspectors were sent to the district inspector with orders that the three cover every foot of the ground. This was accomplished in two days by hard work and late hours. Two reported that the breeding place of the mosquitoes was 700 yards from the nearest camp, and the third inspector stated that the infection was from the aggregate of small breeding places in which the larvae had since been destroyed by oilings. One of the characteristics of the anopheles mosquito is that it is not likely to fly at one time a distance of more than 200 yds. from its breeding place, and that it is seldom found more than this distance from its home.

Comparatively little of the life-habit of the anopheles is accurately known, but the legitimate inference deducted from the known facts are sufficient to establish a working basis, viz.:

(1) That the female anopheles has the hovering instinct for raising her family, analagous to the fish.

(2) That after her eggs are fertilized she is impelled to seek the blood of animals or human beings in order to develop her eggs to perfection.

(3) That after obtaining the necessary blood she seeks her own birth place to deposit her eggs.

Herein lies the weakness of the anopheles female of which man takes advantage. Her home ties hold her from any such migrations as the culex often makes, and being fatally susceptible to the sunlight a clearing of all grass and brush for 200 yds. from her home is sufficient to accomplish her destruction.

Hence the breeding place 700 yds. distant could not be accepted, although it was destroyed as a precautionary measure. A third inspector was sent to Corozal, with orders not to consult with the others, but to remain there until he could positively locate the point of infection. He began by searching each building for adult anopheles. From the building in which he captured the greatest number he started early in the morning when the grass was wet and the mosquitoes were lying low. He followed a zigzag course, turning from point to point as he found the number lessening. This led him to a salt marsh 280 yds. from the buildings. But anopheles do not breed in salt water, and moreover the edges of the swamp were well oiled where fresh water would collect and no larvae were found.

He kept on, and penetrating the jungle 300 yds. came upon a few larvae and pupae. The district inspector appeared on the opposite bank with a machete in hand, saying that he believed the breeding place was in the middle of the swamp, and that he had determined to go in. Go in he did, to his waist, in water and mire, laboriously cutting his way through the branches to the middle of the swamp, where he found the larvae thick enough to blacken the comparatively fresh water. Half a mile away a culvert was found so obstructed that the salt water did not have free access to the swamp during high tide, and the outflow was blocked at low tide. In consequence of the heavy rains the salt marsh had been gradually converted into a fresh water marsh, and as it was filled with rank vegetation, the anopheles were provided an ideal place for life and breeding.

Planks were thrown out into the marsh, lanes were cut in the vegetation and the oilers were set at work. The number of adult anopheles found in the camps began to dwindle at once, and the malaria rate soon fell to normal.

This is only one instance of many similar ones, and it is cited to show the difficulties attending mosquito extermination and the maintenance of good health in the Canal Zone.

ERECTING A LARGE STEEL CHIMNEY STACK IN ONE PIECE.

The accompanying illustration shows the process of erection of a steel chimney which has been temporarily installed at the works of the Crocker-Wheeler Co., Ampere, N. J., pending the construction of a prominent stack at the new power plant. The steel chimney is 72 ins. in diameter and 105 ft. high and weighs with the breeching 18 to 20 tons. It was built at the Dover, N. J., Boiler Works and was erected by the Engineering Construction office of Mr. Walter Kidde. The stack will furnish draft to a battery of water-tube boilers of 800 HP. The Crocker-Wheeler power plant, of which these form a part, will have a total capacity of 4,800 HP.

ERECTING A STEEL CHIMNEY AT THE CROCKER-WHEELER ELECTRIC WORKS, AMPERE, N. J.

CHROME-STEEL RAILS have been made by the Bethlehem Steel Co., of South Bethlehem, Pa., and are being tried by the Boston Elevated Ry. and the Interborough Rapid Transit Co., of New York. The steel is made by the open-hearth process. The addition of a small percentage of chrome is said by the makers to improve the physical properties and to render the steel extremely hard. Although the rails have not been in service long enough to determine their wearing qualities, it is expected that they will wear about three times as long as the ordinary Bessemer steel rails.

THE ANNUAL CONVENTION OF THE AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATIONS.

The annual convention of the American Street and Interurban Railway Associations and of the allied Accountants', Engineering, Claim Agents' and Transportation and Traffic Associations were held at Atlantic City, N. J., Oct. 12, 13, 14, 15 and 16. This was the first convention meeting of the last-named association, whose formation was advocated a year ago. This branch is intended to care for those matters relating rather to the income-producing side of light electric traction than to engineering, accounting or to general industrial or financial policy.

The exhibits were more extensive and elaborate than at previous conventions, and included about all the conceivable supplies or devices that could be employed by an electric railroad. The number and variety of such fittings was so great as to preclude any further mention here.

The growth of the prepayment or "pay-as-you-enter" idea in street cars was shown in the number and variety of such cars shown, on a temporary track run alongside of the convention pier, and by the multitude of fare boxes designed to facilitate the use of these cars.

One of the unique exhibits of the convention was a design of car evolved by Mr. E. A. Barber, while Superintendent of the Black River Traction Co., at Watertown, N. Y. The body is extremely plain in outline, looking at first glance like a mere box with a row of windows cut out all the way around. This particular body was brought about by the necessity for quick and simple repairs. The car was equipped with a simple hydraulic brake. The motorman, in his compartment, operates a long-handled pump which furnishes water to a double-piston cylinder. These pistons directly press the brake shoes against the car wheels through reach rods but with little other brake rigging. The car-body rests on a long-base, four-wheeled truck of the simplest possible construction. The weight of the whole car is about 600 lbs. per seated passenger. The car is much more attractive on the inside than on the exterior. The car proved interesting to the representatives of small roads who have to cut repairs and maintenance expenses to a minimum to make ends meet.

The following officers were elected for the several associations:

American Association: President, J. F. Shaw, of the Boston & Worcester Electric Co.; Vice-Presidents, A. W. Brady, of the Indiana Union

Traction Co., Anderson, Ind.; T. N. McCarter, of the Public Service Railway Co., Newark, N. J.; C. N. Black, of San Francisco, Cal.

Engineering Association: President, Paul Windsor, of the Boston Elevated Railway Co.; Vice-Presidents, F. H. Lincoln, of the Philadelphia Rapid Transit Co.; W. H. Evans, of the International Railway Co., Buffalo, N. Y.; W. J. Harvie, of the Utica & Mohawk Valley Ry. Co., Utica, N. Y.

Accountants' Association: President, R. N. Wallis, of the Fitchburg & Leominster St. Ry. Co., Fitchburg, Mass.; Vice-Presidents, W. H. Forse, Jr., of the Indiana Union Traction Co., Anderson, Ind.; C. L. Wight, of the Des Moines City Ry. Co.; A. B. Bierck, Long Island Consolidated Companies, Long Island City, N. Y.

Claim Agents: President, C. B. Hardin, of the United Railways Co., St. Louis; Vice-Presidents, E. C. Carpenter, Indiana Union Traction Co., Anderson, Ind.; J. S. Harrison, of the Jacksonville Electric Co., Jacksonville, Fla.; F. J. Ryan, of the Syracuse Rapid Transit Co.

Transportation and Traffic Association: President, C. L. Allen, of the Utica & Mohawk Valley Ry. Co., Utica, N. Y.; Vice-Presidents, R. I. Todd, of the Indianapolis Traction and Terminal Co.; G. L. Radcliffe, of the Schenectady Ry. Co.; A. W. Warnock, Twin City Rapid Transit Co., Minneapolis, Minn.

The one piece of apparatus that secured the most attention during the whole convention was the rail-testing machine in the exhibit of the Pennsylvania Steel Co. This machine was designed to determine the actual and relative wearing qualities of different grades of steel rails on sharp curves. Two 33-in. M. C. B. car wheels with independent axles are mounted on the under side of a cast-steel girder which rotates about its center and is driven by a 50-HP. railway motor. The wheels run on a circular track, 20 ft. in diameter, made of three equal lengths of 100-lb. steel rails. The track is bolted and clamped to a cast-iron frame which is fastened by four radial struts to the center bearing and so supported as to appear slightly flexible. The dead load on each wheel is about 7,500 lbs., and this can be increased to 67,500 lbs. by a spring on the center steady pin. By compression springs on the car-wheel axles a lateral thrust of up to 15,000 lbs. can be obtained. The machine is designed for a maximum speed of 85 r. p. m., which gives a train-speed equivalent of 61 mi. pr hr.

REPORTS AND PAPERS.

It would be impossible to present here an abstract of all the reports, papers and addresses of all the sessions and, therefore, mention will be made only of those of most immediate interest to the engineering professions.

ENGINEERING ASSOCIATION.—The address of President F. G. Simmons (Milwaukee Electric Ry. & Light Co.) was largely a review of the efforts of the standing committees. It was stated that there was great need for better attention to the requests for data sent out by these committees to the member companies. The common ratio was about 32 replies received from 200 requests. Mr. Simmons advocated definite recommendations from all standing committees for the standardization of street-railway equipment and practice.

The report of the Executive Committee included minutes of all the meetings of that committee. An arrangement of standing committees and their interrelations was formulated. These committees were to be on (1) Standards, (2) Way Matters, (3) Equipment, (4) Power Generation, (5) Power Distribution. It was proposed that the Standards Committee should have nine members, four of whom should be the chairmen of the other committees, four of whom should be appointed from lines of work taken up by the other committees, and a ninth member appointed at large. All recommendations of the other four committees for standards are to pass to the Standards Committee for approval and reporting to this association.

The report of the Committee on Maintenance and Inspection of Electrical Equipment was a voluminous document containing recommendations and specifications for testing carbon, brushes, insulating repair materials, gears and pinions and for the inspection and renewal of lubrication, armature and axle liners, trolley wheels, air compressors, control apparatus, etc., etc. The most interest of this session was displayed in the matter of testing carbon motor brushes. The committee started with a very general classification, as: (1) coke brushes for slow-service and up to 50-HP. motors—a brush with considerable abrasive and polishing effect; (2) part coke and part graphite brushes for motors of 50 to 100 HP., on interurban and suburban service—a brush with slight abrasive effect; (3) graphite brushes for 100-HP. motors and larger—a brush with very low abrasive and high lubricating effects. It was recommended that a class 1 brush should have about 5% ash ($Fe_2O_3 + SiO_2$), and a class 2, 2 to 3%, and a class 3 less than 2% to secure the desired abrasion. The brushes are to be given a mechanical test in a special device to be known as a "vibrator." This consists of a broad-faced ratchet wheel, 9¼ ins. in diameter, having eight 1/16-in. teeth. The brush is held against the face of this wheel by a standard brush holder. The ratchet should be run backwards at a speed of 250 r. p. m. so that the brush is gently raised and suddenly dropped, 2,000 times per minute. It is suggested that a class-1 brush should stand 20,000 revolutions; a class 2, 30,000; and a class 3, 50,000 revolutions without breaking or chipping. The current capacity of the brush is to be determined while running against an 8-in. slip ring, revolving at about 500 r. p. m., with a pressure of about 7 lbs. per sq. in. of brush surface. It was recommended that a class 1 should carry 100 amps. per sq. in. without glowing; that a class 2 should carry 150, and a class 3, 200 amps. The recommendations represent the first attempt to have standard requirements for testing these most important electrical supplies. The recommendations were, on the whole, approved by the carbon manufacturers present. It was made plain, however, that while the tests proposed would give a reliable indication of whether or not a kind of brush would prove serviceable, yet the test conditions imposed were not like practical conditions.

As a part of the discussion on this report Mr. E. E. F. Creighton, of Schenectady, N. Y., read a paper in which he first sketched the lightning troubles that might occur on a typical railway circuit—13,000-volt alternating-current transmission and 600-volt direct-current distribution. These effects were briefly: (1) direct discharge from cloud to line, (2) induced charge from nearby stroke, (3) arc from the alternating-current line to the ground, causing surges, (4) short circuit of one phase of the transmission causing surges in the other phases. It was stated that there was no adequate protection against the infrequent direct strokes, but that the other effects might be relieved by new multigap and aluminum arresters. The use of two types of aluminum arresters, one for direct and one for alternating-current lines was described. In these the counter electromotive force of plates in liquid balances the normal potential, and only when excessive potentials arise is there an appreciable discharge. When the abnormal voltage has been reduced by this discharge the counter electromotive force of the plates restrains the flow of current from the generators. These arresters are used without spark gaps on direct current and with gaps on alternating current to reduce the charging current of the arrester acting as a conductor. The spark gap in these cases is set only slightly above normal voltage.

The report of this committee with its recommended tests was adopted.

The report of the Committee on Standardization considered only those subjects closely related to the establishment of a standard height of car equipment above the level of rails. These subjects were (1) standard automatic couplers, for interurban cars, and radial draft rigging, (2) standard heights of couplers for city and interurban cars, (3) standard height of platforms, bumpers and steps.

It was reported that the standards recommended last year for axles, journal brake fittings and wheels were being widely adopted by operating companies and manufacturers generally.

The committee found no accepted practice for heights of equipment above car rails and made the following recommendations for standard dimensions:

	Interurban, ins.	City, ins.
Height from top of rail to center of coupler	35	20
Height from top of rail to bottom of bumper	43	25
Height from top of rail to top of bumper	51	31
Width of bumper	8	6
Length of radial coupler from center of pocket-pin to pulling-face of coupler	54	54

The following additional figures were stated as good practice, though not recommended as standards:

	Interurban, ins.	City, ins.
Height from top of rail to top of tread of first step	17	17
Height from top of rail to top of tread of second step	29	..
Height from top of rail to top of third step	40	..
Height from top of rail to vestibule floor	51	31
Height of raise from vestibule platform to floor of car	..	10

The committee held that no automatic coupler had been devised that allowed interurban and steam-road cars to be operated together over sharp curves and sudden grade changes. It was further recommended that the bumpers on cars should be equipped with castings of such design (corrugated or toothed) that they would engage and prevent one car riding over another and telescoping. Such castings should preferably be on city cars, with lower platforms, and should have a pocket for coupling to interurban cars.

The discussion on this paper was free and the height of car steps noted as "good practice" came in for much criticism. Mr. J. F. H. Wyse, engineer of the Ontario Railway and Municipal Board, stated that a great number of prominent physicians in Ontario had formally demanded that the present steps be made lower. The present practice was close to that recommended by the committee. The general sentiment of the session that the steps noted were too high for the very young, the aged and the infirm.

Mr. E. W. Olds, of Milwaukee, described a construction of city and interurban cars by which a low step had been secured. The side sills were placed above the car floor and the center sills below. With 36-in. wheels this gave a floor 42 ins. above the rails. With 33-in. wheels, for city cars, a floor could be built 38 or 40 ins. above the rails. This was cited to support the view that the physicians' demands could be met.

Mr. J. S. Doyle (Interborough Rapid Transit Co., New York) cited cases where the use of toothed bumper plates had prevented telescoping and had probably thus saved many lives. Much doubt was expressed by other persons as to the possibility of putting a bumper plate, 20 ins. high, above buffer beams on city cars that would prevent an interurban car overriding and telescoping the lower city car.

The report was adopted after being amended so that the dimensions of steps proposed as "good practice" were designated as maximums.

The report of the Committee on Power Generation contained results of a canvas of member companies to secure data on the practical operation of (1) steam turbines, (2) steam meters and (3) flue-gas analyzers. From a total of 234 enquiries 32 replies were received on turbines, 2 on steam meters and 14 on flue-gas analyzers. On account of the small number of railway stations using steam meters the experience of 20 industrial concerns was secured.

A general survey of the answers to the questions sent out shows, in reference to prime movers, that the cost of repairs and maintenance is favorable to the turbine; that there is no marked difference in fuel economy between turbine plant and a reciprocating-engine plant of the same capacity under the same load; that the turbine is considered by most operators as more reliable than the engine; that steam-driven

auxiliaries are preferred; that most stations superheat the steam for turbines; that the erosion of blades has not been a large factor in determining maintenance or economy.

The committee found that steam meters have been used largely in industrial plants where the steam consumption was small, but that satisfactory results were obtained and that they were reliable for heavy duty in many ways, such as obtaining steam rates of power units, for obtaining equal service from various boilers, for dividing steam charges to various sections of a power-generating station such as railway lighting, stationary, power, etc., etc., and for determining losses through traps, pumps and in pipe condensation.

Flue-gas analyzers were generally accepted as of service, in detecting excess air, admitted to the fire or leaking in at different points. It was reported, as the consensus of opinions asked, that the best results had been secured with a recording analyzer in the main flue supplemented by indicating instruments in the breeching of each boiler so placed that the firemen could easily see the readings.

In the discussion, Mr. Chas. Hewitt, of the Philadelphia Rapid Transit Co., stated that in Philadelphia it had been found that the combination of an exhaust turbine with a well-designed reciprocating engine was more economical than any possible arrangement of either turbines or engines alone.

The Committee on Power Distribution laid out a plan of work to be followed by successive committees in the standardization of practice and material. The work to be done includes the consideration of (1) high and low-tension feeders, (2) ordinary and catenary-trolley, third-rail, underground and local-contact working conductors, (3) return system, (4) conduit lines. The report of this year's committee took up only the first and second items, and little was done with the first except to call attention to the abandonment of lead sheathing on certain underground feeders with reliance wholly on the moisture-repelling qualities of the rubber insulation.

The committee recommended a standard height of trolley wire of 19 ft. above the rails. After noting the excessive deterioration of both wood and steel poles at the ground line, it was recommended that an iron sleeve, 2 ft. long, should be shrunk on each iron pole at such a point that it would project above the ground line 1 ft.

Six roads reported on the results of third-rail operation; three of these were of under-running and three of over-running type. It was found that the spacing of supports varied from 5 ft. 6 ins. to 11 ft., and the committee recommended the use of 10-ft. spacing with 30-ft. conductors and 11-ft. spacing with 33-ft. conductor rails. The breakage of insulators for the over-running constructions was reported as 2.76% per year, and for the under-running, 3.36%. Where the third-rail was supported on construction entirely independent of the track structure (Subway of the Philadelphia Rapid Transit Co.) there had been complete freedom from insulator breakage.

This report also included a paper by Mr. R. L. Allen, of the Archbald-Brady Co., Syracuse N. Y., entitled "Application of the Theory of the Catenary to Electric Railway Work." In this a method was outlined for adjusting a single catenary, unloaded, so that it would take a certain deflection after being fitted with trolley wire and hangers.

After some discussion as to the standard height of trolley wire the report of the committee was adopted.

The report of the Committee on Control embodied two papers on railway motor control. One of these, by Mr. F. E. Case, of the General Electric Co., Schenectady, described the Sprague-General Electric system of automatic control, which by a system of current-limiting relays prevents more than a certain acceleration rate of the car. The second paper by Mr. William Cooper, of the Westinghouse Electric and Manufacturing Co., described both alternating and direct-current motor controlling systems with special reference to automatic car acceleration and multiple-car train control.

The report of the Committee on Car and Car-House Wiring related their labors with the Underwriters' National Electric Association to secure less stringent rules for the installation of car heaters, lamps, etc., on insured cars and of car-house wiring and interior rail bonding in insured buildings. The committee's work was only partially successful, and in accepting the report the convention requested the new standing committee to assemble all insurance rules on cars and car-houses for the consideration of operators with a view of ascertaining all the desired changes.

The report of the Committee on Operating and Storage Car Barns was a resume of the requirements for the design of barns. The subject matter was arranged under several heads: (1) selection of location, (2) study of track layout, (3) design of building, (4) study of details.

The report of the Committee on Way Matters was formed by three papers on track work: (1) "A Proposed New System of Street Railway Construction," by Mr. C. B. Voynow, Philadelphia Rapid Transit Co.; (2) "Life of Manganese Steel Rail on Curves," by Mr. H. M. Steward, Boston Elevated Railway Co.; (3) "The Open Tank Method of Preserving Timber," by Mr. H. F. Weiss, U. S. Dept. of Agriculture, Washington, D. C.

The first paper was a rather general presentation of a scheme for rails and car wheels with the flange on the rails and not on the wheels. The proposed wheels would have their tread the shape of the present tread of T-rails, and vice versa.

The second paper gave the results of the use of some cast manganese-steel rails installed on sharp curves of the Boston elevated railway, where excessive wear was noted. It was found that the life was about 40 to 50 times that of open-hearth rail, 25 to 35 times that of ordinary Bessemer, 6 to 10 times that of high-carbon Bessemer, and 15 to 20 times that of nickel-steel. The comparative maintenance cost of one particular curve was given as $7.01 for manganese rail and $41.50 for the ordinary Bessemer, for a period of eight years.

The third paper of this report was a quite general outline of the "open-tank" method of treating wood with preservatives as developed by the U. S. Forest Service since 1904. It was stated that the moisture in the cells of green or seasoned wood could be driven out by soaking in hot oil. If the wood then be placed in cold preservative, either oil or aqueous solution, the cooling produced a tendency toward vacuum that drew in the preservative to a remarkable extent. It was stated that by this open tank treatment 83% of total filling of air spaces had been secured. Plants were being built for this treatment for as little as $5. Plants for treating posts cost from $35 to $180, and have a capacity of 50 to 200 posts per day. The more complete plants, for treating large timbers, in which the liquid was moved rather than the wood, cost from $5,000 to $8,000.

In the discussion of this paper it developed that the treatment of at least partially seasoned timber had been found much better than of green wood. Mr. E. F. Hartman, of the Carbolineum Wood Preserving Co., in reply to enquiries from delegates, stated that for wood structures where decay might be suspected to be under way could best be treated by brushing with coatings of some antiseptic preservative. He gave the cost of dipping or brushing new timber as $8.33 per thousand board feet, an average of all sorts of lumber. The cost of treating cross ties averaged $8.68 per thousand board feet.

TRANSPORTATION AND TRAFFIC ASSOCIATION.—The address of the president, Mr. C. Loomis Allen, of Utica, was largely on the proposed work of this new association. The accountants, claim agents and engineers were held to be consumers of the gross earnings which it was the work of the transportation and traffic men to produce. It was held that this fact alone made the field of the traffic association broader than that of any of the other allied bodies, and necessitated the expenditure of much time, energy and money if useful results were to be obtained. It was believed that the work could be most successfully carried on through committees which should not merely meet a few weeks before the convention to wonder what facts should be presented or in what form, but which should study traffic conditions on the properties of member companies, determine what was abnormal, find the remedy and finally reduce their work to written form for presentation and discussion at conventions. The work of the association was further to be the insistence on traffic and transportation standards by the member companies, for the perfection of service to patrons and toward the adoption of these standards by national, state and municipal commissions. It was Mr. Allen's contention that the convention sessions should be largely devoted to the consideration of committee reports, with little time spent on individual papers, and these few on subjects not well adapted for committee work. The committees appointed, on "Training of Employees," "Promotion of Express and Freight Traffic," "Promotion of Passenger Traffic," "Rules for City Operation," "Rules for Interurban Operation," were expected to show the wisdom of the plan inaugurated.

The report of the Committee on Transportation Employees was a summary of the practices of member companies, so far as it had been possible to obtain them, in respect to standards for acceptance of applicants for positions as motormen and conductors, and for their subsequent training, education and discipline. It was claimed that the selection and education of motormen and conductors had not kept pace with the evolution of electric railroading. But as 187 member companies had replied to requests for information, it was believed that there was a live interest in the subject. Only 13 companies employed motormen under 21 years of age and only 18 went under that limit for conductors. Most of the roads attached no importance to height and weight requirements. Men without previous electric-railway experience were preferred by 104 companies and only 8 preferred city to country-bred men. Of the companies reporting, 74 have no vision test, 88 have no color test, 88 have no hearing test, 97 have no physical examination. After accepting an applicant 148 companies put both conductors and motormen on a car with an instructor, and 20 companies more do this, but give the motorman shop instruction first. No shop instruction is given to motormen by 100 companies, and 150 have no training school plant. The length of instruction period is left to the judgment of the instructor in 114 companies. An examination at the close of the instruction period is given by 156 companies, and in 128 cases it is oral. Educational work is maintained by only 81 companies. In maintaining discipline 43 companies use a scheme of reprimand, suspension and dismissal; 26 use a merit or demerit system, and the rest operate variously. After reviewing the practice touched upon in the foregoing, the committee made several recommendations, which were adopted. These provided for age limits of both conductors and motormen at 21 and 45 years; for a height limit of 5 ft. 6 ins., and for motormen a minimum weight of 150 lbs.; for conductors the weight limits were 130 and 200 lbs. Standard physical examinations—general and special—were provided by forms submitted with the report. The committee recommended educational work for the development of employees and the use of a merit and demerit disciplinary system.

"How Can the Small Road Best Promote Traffic and Increase Revenue?" was the title of a paper by Mr. E. Gonzenbach, General Manager of the Sheboygan (Wis.) Light, Power & Railway Co. This paper was written in a rather picturesque style and with a tendency toward humorous vernacular, but there were many points of interest to operators of small roads, particularly as they dealt with conditions not prevailing on most lines east of the Alleghenies.

It was stated that the problems that were greatest to the large Eastern systems did not worry the managers of Western interurban lines, whose struggles were for increasing traffic and revenues. They found it highly desirable to cultivate the riding habit among those classes who might become habitual riders—the workingmen and women shoppers. One way that had been found useful, in interesting the first-named class, was by "losing" strips of marked tickets in certain sections of the city. The shopping traffic had been stimulated during a non-peak load part of the day by selling tickets, good only between 9 a. m. and 4 p. m., seven for 25 cts., at all the dry-goods stores. After this class of traffic had been developed for a year and a half, the special rates were removed and the shoppers continued to travel at full fare, but still in non-peak load parts of the day. It was contended that in most towns the headway and number of cars could be considerably reduced, and by holding the mortormen to a strict schedule a service equally acceptable to the public had been given. The author advocated the cultivation of pleasure traffic, not by maintaining amusement parks but by keeping a good roadbed through woodland or by some lake or river where an outing could be enjoyed. The author was very pronounced in his condemnation of the amusement park as a reducer of net income by swelling operating and maintenance cost more than income. In the West special-express service had proven desirable for handling that class of traffic which would stand good remuneration for quick transportation. Employees were trained to be both conductors and motormen. These "trainmen" were shifted from time to time to keep them in practice in both capacities. Greater attention was urged for buying supplies in large quantities for cash prices. It was claimed that engineers and manufacturers were almost in connivance to force the operators to install greater power equipment than was really necessary. It was claimed that it had been generally demonstrated that the power input saved by the smaller cars and smaller motors and generators far overbalanced any increase in repairs and depreciation due to having smaller equipment than generally recommended by the engineers and manufacturers and forced upon the promoters.

AMERICAN ASSOCIATION.—All the sessions of this parent association were executive in nature and accredited delegates were admitted by ticket. The presidential address was presented in manuscript, owing to the absence of the president, C. G. Goodrich, of Minneapolis. The address had for its main topic the advisability of holding the meetings of the various allied associations at different times and places. The step proposed, however, was so radical that no immediate action was taken. At a later session of this association a committee, consisting of the incoming president and seven other persons, was appointed to investigate the advisability of this move and to report to the members at least 30 days before the next convention of the association.

The report of the Committee on Education was a discussion of the advisability and means of educating employees preparatory to employment and during such service. An investigation was reported on the technical schools and colleges of the country. It was found that very few had established complete courses in electric railway engineering, but that all give courses in such subjects as a part of the general electrical-engineering courses. The report described the methods of apprentice training of the New York Central Railroad, of the Edison Electric Companies, of the trustees of the Gas Educational Fund, and reviewed the Master Mechanics' Association report on apprentice systems. The present work on street railway systems was found to be very limited, and the committee quoted statements of officials of the Public Service Ry. Co. of New Jersey, and the Rochester Ry. Co. as showing desirable practice. Mr. R. M. Searle, of the Rochester company, informed the committee that:

It has been our practice every year to put on a number of cadet engineers, at, say, $50 or $60 a month, the idea being to give them a salary that would clothe and board them, and let them maintain sufficient self-respect to take up that which for two years is ordinarily a post-graduate course.

About two men out of five stick or succeed along the channels we lay out. They are given everything to do from shoveling coal to actual executive work, and one of the chief things we teach them now is the necessity of having tact, not only with men under them, but with the public.

The fact that we are continually approached by outside companies for our cadets after training is a gratification to us, and indicates that the lines we are following approach good practice. We have found that the average college graduate in true commercial lines at the outset of graduation is almost useless and hopeless, leaning too much on what he has learned at college and not using it to his advantage. It takes him at least two years to reach his equilibrium, and then if he has an initiative left he manifests to his colleagues or competitors the superior benefits of his technical education.

Mr. R. E. Danforth, of the Public Service Ry., made this statement of the practice of that corporation:

Applications from graduates of technical schools have been regularly coming in for years, and as specially trained college graduates were being successfully employed as apprentices or cadets by the gas department of the Public Service Corporation, the management of the railway authorized the employment, and education along systematic lines, of a number of cadet engineers.

It has been found that college graduates having natural mechanical instinct, or being naturally inclined toward the railroad business, and with ambition, learn the rudiments of the road with great ease and rapidity and that after weeding out the constitutionally unfit, the remainder drop into positions in the organization where they become valuable to their superiors by reason of their loyalty, eagerness to learn, and to do well their various tasks. In order to make it unnecessary for the company to look outside for foremen, superintendents and other employees having the administration of the company's affairs in hand, an effort is being made to have in training an understudy for each foreman or head of department and to gradually work into the organization as many well-trained men as possible, so that eventually the leading positions of trust and responsibility shall be held, as far as possible, by those capable of further advancement.

The education of young men is now being carried on under two heads, "Apprentices" and "Cadets." The former are employed by the various departments and remain in such departments. The latter are given work in each branch of the business according to a fixed schedule, after completing which they may be used where they can be of the greatest service to the company. This work in the various departments gives them a broader field than that open to other employees and they may thereafter be moved from department to department as seems best.

Cadet engineers are at present working according to the following schedule:

Maintenance of cars and equipment	6 months, as follows:
General repair shop	5 months
Car house pits	1 month
Maintenance-of-way	4 months, as follows:
Timekeeper and inspector	1 month
Sub-foreman of track gang	3 months
Maintenance of overhead line	2 months, as follows:
Repair wagon	1 month
Bond testing car	1 month
Transportation department	7 months, as follows:
Car house	3 months
Inspector	2 months
In division superintendent's office	1 month
In general superintendent's office	1 month
Claim department	3 months
Power stations	3 months

In the discussion on this report Mr. H. F. Grant, of Seattle, described the system followed by the Stone and Webster corporation. While they did not go into the work of training shop men or apprentices, they did have what they called a "student course." They secured from some of the technical schools a few of the best men who desired to enter street railway practice. They were first placed in the Boston office, where they were given opportunity to study the systems of reports and details of operation of the 30 odd companies controlled by the corporation. These men were usually started at $60 per month. Later they were sent to the various properties of the corporation; some went into power stations, some into the substations, some into more general mechanical or electrical engineering and some into transportation departments. From the large number of men secured each year it has been possible to discover those men with proper qualifications for filling the more important positions. The speaker stated that he had in mind four students who entered the corporation's employ less than six years ago who were now managers of small operating companies.

A report was made by the Committee on State and Federal Regulations of which Mr. G. H. Harries, of Washington, D. C., was chairman. No official account of the contents of this report or of the nature of the discussion on it was given out. It was currently reported, however, that at the time set for the discussion of this report that Mr. T. N. McCarter, of the Public Service Ry., Newark, N. J., attacked the principle of giving broad powers to public service commissions like that of New York State. It was reported that he favored a commission of the type existing in Massachusetts. In reply to this Mr. W. Caryl Ely is reported to have vigorously maintained that the New York State Commission provision was no more radical than that in Massachusetts, but that Massachusetts was more prepared to have its public utilities so regulated and that they needed such control less. This matter is more fully discussed on our editorial pages.

A NEW REVOLVING SEWAGE SPRINKLER.

A revolving sewage sprinkler for percolating filter beds, designed by a Mr. Cutler for the proposed new sewage works at Belfast, Ireland, is described as follows in a report on Sewage Purification for Belfast by Prof. E. A. Letts, of Queen's College, Belfast:

The revolving sprinkler or spreader which it is proposed to use in the sewage works has been designed by Mr. Cutler to obviate the loss of head usually involved in driving the sprinkler, and to secure as nearly as possible the distribution of equal quantities of sewage per unit area on the percolating filter beds. The sprinkler depends for its action on the following principles:

(a) The area of bed to be sprinkled by each unit length of an arm of the sprinkler is proportional to the distance of the center of that unit length from the center of revolution of the sprinkler.

(b) The discharge per unit time from an orifice is proportional to the square root of the head of liquid above the orifice.

(c) The head produced by centrifugal force at any point in the arm is proportional to the square of the distance of that point from the center of rotation. [The head necessary to overcome friction and to produce the flow along the arm is provided by giving the necessary inclination to the arm.]

If G = maximum quantity to be distributed over each square yard of bed in gallons per 24 hours,

A = total area in square feet of the orifices occupying one foot length of the arm,

R = mean distance in feet of those orifices from the center of rotation,

Q = quantity to be delivered by those orifices in cubic feet per second,

H = head in feet produced by centrifugal force at distance R ft. from the center of rotation,

N = number of revolutions of the sprinkler per minute,

Then $H = .00017\, N^2 R^2$,

and $Q = 4.97\, A \sqrt{H}$;

$$\text{also } Q = \frac{2 \times 3.14\, R\, G}{4,860,000},$$

$$\text{from which } A = .00002\, \frac{G}{N},$$

assuming that distribution in any part of the bed is from one arm only.

This result shows that uniformity of distribution can be obtained with a mechanically driven sprinkler by making the orifices in the arms of equal size and equal distances apart, and that whatever means be adopted to secure uniformity of distribution over the bed, such uniformity can only be maintained when G/N is constant.

In the above calculation the ordinary formula (with coefficient .62) for discharge through orifices has been used, which is based on the assumption that discharge is taking place into an atmosphere of the same pressure as that on the surface of the liquid; but it is manifest that the formula requires modification if accuracy is desired in determining the quantity passing through the orifices, as they are sometimes moving with and sometimes against the wind, and as at all times, even in a still atmosphere, there must be a reduced atmospheric pressure on the side of the arm from which the jets are issuing.

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Two weeks ago the city of Hartford, Conn., spent many thousands of dollars in a three-day celebration of the opening of a magnificent new masonry arch bridge across the Connecticut River and a fine boulevard along the river front leading to the bridge approach. No doubt the completion of the bridge and boulevard were made the occasion to demonstrate that love of the spectacular which people in our modern and prosaic age are ashamed to yield to without some special excuse. Doubtless, too, the advertising the city received fully repaid its citizens for the time and money expended; but in spite of the materialistic view, the city has the right to a pardonable pride in its work.

And this pride need not be so much in the bridge itself, although the extra expenditure of perhaps a million dollars for a permanent and beautiful structure is a trifle unusual, but rather in the appropriation of a million and a half for the construction of a wide and spacious boulevard where before had been dingy storehouses, noisy and ill-smelling yards and poor and disreputable rookeries.

The river front of an American city is usually its most squalid district. In cases where a river is used for commerce, there is of course necessary a certain district where wharves and warehouses and railway terminals occupy all the space; but it is not essential that the entire water front be devoted to such uses. The aesthetic possibilities of water frontage for parks and public pleasure grounds and for high class residence sites are beginning to be appreciated in this country. European cities are an object lesson to us in this respect. The Seine with the beautiful bridges across it is the glory of Paris. Warehouses and other facilities in connection with the water traffic are confined to one particular section of the city away from the part where art and architecture reign supreme. In London the upper reaches of the Thames are a center of attraction for recreation and sport. Many other English cities have by the building of dams and locks created beautiful streams for boating, and choice sites for residences out of streams which in their natural state were dirty tidal estuaries with ragged banks and foul shores.

However, we have the beginning here of better things, particularly in the Eastern states. The Schuylkill parks in Philadelphia, the Riverside Drive in New York, the Rock Creek Valley development in Washington, and Boston's Charles River improvement are all examples of the enormous value of fine water frontage when properly improved for recreation and pleasure.

It is pleasant to record the admission of Hartford to the list of municipalities which have awakened to the artistic value of its water frontage. Already the city had an admirable system of parks, and its railway entrance, with its charming outlook upon state-house and surrounding grounds, is unique in presenting the best view of the city first. Hartford is to be complimented on its good beginning in the decoration of its back gate now that the front is so well taken care of.

Any dust of combustible material, floating in the air in sufficient quantity, may under proper conditions give rise to an explosion. This fact ought to be indelibly written in the mental notebook of every engineer. The most recent illustration of this physical fact is the disaster at Richford, Vt., described in this issue, in which some 17 persons lost their lives and property to the amount of nearly half a million dollars was destroyed.

It may seem strange to some that so small an amount of dust as will float in air can actually cause an explosion; but if one will recall a little elementary chemistry, the difficulty disappears. Practically all combustible materials met with in the form of organic dusts are hydrocarbons and combustion is merely the process of chemical combination with oxygen, the hydrogen and oxygen forming water (H_2O) and the carbon and oxygen forming (if complete combustion takes place) carbon dioxide (CO_2).

In both these combinations the oxygen required weighs several times as much as the combustible, and as the air contains less than one-fourth (by weight) of oxygen, the quantity of air required is over four times as great as the amount of oxygen. Thus, when we allow for necessary dilution of the products of combustion, it appears that for every pound of hydrogen burned in a furnace some 50 lbs. or more of air must enter, and for burning ordinary soft coals probably as much as 30 to 40 lbs. of air per lb. of coal is required. The air in a room 10 ft. square and 8 ft. high would weigh about 60 lbs., and it would require less than two pounds of dust disseminated through it, to use practically all the oxygen in the air. Probably a much smaller quantity of dust, perhaps half a pound or less, would be sufficient to propagate a dust flame through the air and cause an explosion.

It may be worth while to explain, too, the fact that such an explosion is merely combustion taking place very suddenly. Even the so-called explosion of gunpowder is merely a combustion process, and this may be rapid, as in the case of small arms powder, or slow, as with the large grain powder used for heavy artillery. Whether it be the carbon and sulphur in gunpowder uniting with the oxygen locked up in saltpeter, or the hydrogen and carbon in a combustible gas uniting with a mixture of air, or the hydrogen and carbon in particles of the dust of flour or sugar or soft coal uniting with air—the result of sudden combustion is the same viz., the almost instantaneous liberation of a great quantity of gaseous products, many times in volume that of the elements before combustion, and enormously expanded by the heat generated by the chemical combination. It is this great volume of gases which does the mechanical work—pushes the projectile, rends asunder the rocks, or does destructive work—in that form of combustion which is commonly called an explosion.

The important thing for an engineer to bear in mind is that an extremely small amount of dust floating in the air can cause an explosion, and that under favorable conditions a small flame or spark from any source may be the initial starting point of an explosion. A match trodden under foot, an overheated bearing, frictional electricity from a belt, or a discharge of lightning, are examples of common sources of flame about any industrial plant, and it is far easier to guard against dust in the design and operation of the plant than to guard against such accidental sources of fire.

It may be said, however, that while the danger of combustible dust is known we are more or less in the dark as to the limitations of these dangers. It would be an interesting line of research for some of our college laboratories to investigate the combustibility of different organic dusts and the mixtures of dust and air necessary for a flame to be propagated through the mass.

In discussing the proposed system of reservoirs in the upper Ohio River Basin, in our issue of June 11 last, we called particular attention to the value of storage reservoirs on a stream in maintaining the low water flow, and referred to the condition of the Monongahela River at Pittsburg during seasons of prolonged drought.

The dry weather of the present summer and fall has given abundant illustration of the need of river regulation, to maintain the low water flow, all through the Ohio valley and indeed all over the North and East. The following press dispatch from Parkersburg, W. Va., dated Oct. 6, tells the story in condensed form:

> PARKERSBURG, W. Va., Oct. 6.—The continued drouth throughout this State is again becoming serious. In some localities the conditions are such that the health of the community is in grave danger. This is true in some sections near the smaller streams, which are drying up to such an extent that the fish are dying off by the thousands. In order, if possible, to prevent an epidemic of any kind, the dead fish are being buried.
>
> The situation is also reported grave at points along the Ohio River, owing to the filth which finds its way into the river from the sewerage systems of many of the cities and smaller towns.

It may be claimed that this report is exaggerated; but many other press items of similar purport indicate its substantial accuracy.

At Columbus, O., reports refer to "the terrible nuisance arising from the low water of the Scioto River during the summer months. It appears that a State dam holds the water of the river in a standing pool during low water periods, and although it is the intention ultimately to treat all the sewage before discharging it into the river, at the present time a considerable proportion finds its way there.

The upper Ohio River appears to be at a lower stage than ever before recorded. At Wheeling, W. Va., during early October the river ranged 3 to 6 ins. below the low-water mark on the gage. Of course this means that all the tributary streams are at a similar low stage.

It is an interesting question to consider what the situation would be in the Ohio River to-day were the complete system of slack-water navigation by locks and dams in operation as recommended by the Government engineers. Definite statement is, of course, impossible, but it may be queried whether with the greatly increased evaporation from the pools which the dams would create and with the considerable amount of leakage at the movable dams, the flow of the river might be reduced to such an extent that navigation would be interfered with. Of course it is understood that the water used for lockage from one pool flows into the pool next below and becomes available for use there. In the Monongahela pool at Pittsburg, however, there are said to be over 12,000,000 bushels of coal loaded in barges and awaiting shipment. It is claimed to be difficult to maintain the height of this pool even now with navigation suspended, and if water were being drawn off to pass boats down-stream, the pool depth might be seriously reduced.

But even if this were not the case, the sanitary condition of the river at extreme low water when reduced to a series of stagnant pools, and receiving all the sewage and filth of the cities along its banks gives reason for apprehension. There is not the same amount of aeration in the slow movement of the water in a big pool that exists in a stream flowing naturally. This

is the water, it must be remembered, which Cincinnati and Louisville and other cities along its course rely upon for their potable supply.

We believe these matters should be given serious consideration by those who are studying the great question of river regulation with a view to definite action. Even if it be demonstrated that the reservoir system cannot be carried out on a scale sufficient to control floods or to reduce the amount of work necessary to complete the slack water navigation system, it may yet be found advisable to build some reservoirs on the most advantageous sites for the sake of supplementing the low water flow of our streams.

STREET RAILWAYS AND STATE COMMISSIONS.

The Public Service Commission law in New York has been generally considered a long step in advance in the control by the State of natural monopolies. The law has been criticised, it is true, by a certain class who would take far more radical measures with the so-called trusts, and also from an opposite direction by another class of men who find their operations in high finance interfered with.

It is passing strange, however, that Mr. Theodore P. Shonts, who not long since held a high position of trust under the Federal Government, should go out of his way, in his speech at the recent Deep Waterways Convention at Chicago to denounce this law. The following extracts fairly represent Mr. Shonts' position:

> We have in New York State to-day practical operation of transportation lines by commission. The commissions may compel railroads to change or add to their structures, to change or add to the operations of trains, to change their rates, or to change the kind and quality of rolling stock, their terminal facilities, motive power or any other property or device used.
>
> We do not know who the next commission will be or what it will do. Until legitimate regulation is substituted for the physical operation which is now authorized there can be no railroad progress in New York or any other state which has analogous laws.
>
> Rather than see this anomalous condition become general and permanent, I, as a railroad man, would prefer governmental ownership and operation of the railroads, dangerous as that would be to the maintenance of our liberties, because operation without ownership not only destroys the initiative by destroying the hope of reward to the individual officers and dries up the fountains of money supply, which are necessary to keep the railroad development abreast of the traffic requirements, but also because of the fact that the commissions which operate the railroads have no financial responsibility and are not held accountable for results.
>
> The idea of operation through commissions is the illogical outcome of public measures at first preventive and justified, but which, with the swing of the pendulum, have become a dangerous interference in matters which have their private as well as public concern and which, if extended, will portend disaster.
>
> The danger is not in the commissions as they are now made up, but in the law itself; in the fear on the part of the investors in railroad securities that the management of their properties will be taken out of the trained hands which now direct them and placed in charge of men who know nothing about railroad operation and have no financial responsibility.
>
> Do not misunderstand me. I believe in supervision or regulation by commission. I think the welfare of the country and the welfare of the railroads require the existence of such bodies, and that they be clothed with powers sufficiently broad to enable them effectually to protect the public welfare.

Let us study this last paragraph of Mr. Shonts' speech a little. He says that he believes in Commissions, and believes that they should have power enough to protect the public. But if he really and heartily believes this, on what grounds does he object to the New York law? As we read that statute, the Commission are clothed with only such powers as practical experience has shown to be essential for the protection of the public. Mr. Shonts is a newcomer to New York and may be unfamiliar with recent history there. The fact is that the kind of Commissions of which Mr. Shonts apparently approves—the kind which "protect the public welfare" on paper, only—has been thoroughly tried in New York.

Many beautiful theories have been broached about the power of publicity and the influence of a Commission with merely advisory powers. New York had tested these theories and found them wanting. Indeed, she had done more than this, for the old Railroad Commission and Gas Commission in New York, which were abolished when the Public Service Commission came into being, had very considerable powers of control over the corporations under their jurisdiction. The Public Service Commission Law which Mr. Shonts so deplores, was not, therefore, the swing of a pendulum to an extreme, as he claims. It was merely one step farther in the necessary public regulation of natural monopolies in transportation.

And now let us turn to Mr. Shonts' charges in detail. He intimates that the operation of New York's railways is in the hands of the Public Service Commissions. That they have broad supervisory powers to protect the public interest is true, but the idea that the "physical operation" of all the steam railways and street railways and gas works and electric plants in the State of New York is being conducted by the ten men who make up the Public Service Commissions is absurd on its face. The Commission is not interfering and has no time to interfere with the normal operations of the corporations over which it has supervision. As for the abnormal operations—if the Commission had done nothing else, its exposure of the series of financial crimes in the recent history of the corporation which Mr. Shonts heads would alone have justified the act by which this Commission was created.

No, Mr. Shonts, The public of New York has tried that sort of mild regulation of its public corporations for which you profess an affection over a score of years. It was under that sort of "let-alone" regulation that a long series of frauds was perpetrated on the public and the financial community in connection with your own corporation, extending all the way from Jake Sharp and his Broadway franchise steal to the Interborough-Metropolitan merger.

Your corporation and its officials cannot well complain of the Public Service Commission Law, for it was the outrageous disregard of public rights and common honesty in connection with the New York street railways that had greatest influence in placing that law on the statute books and causing it to be framed on stringent lines.

It is a pleasure, now, to turn from Mr. Shonts' recent speech—which so far as we have seen has received not one approving word in the public press—to the American Street Railway Association Convention, at Atlantic City last week.

One of the subjects scheduled for discussion there was the relation between street railway companies and State Commissions. The proceedings of the association are conducted behind closed doors, but a report of the session bearing evidence of substantial accuracy was given in the Philadelphia "North American." According to this report, a leading part in the discussion of this subject was taken by Mr. Thos. N. McCarter, President of the company which controls all the street railways and other public service corporations in the New Jersey suburbs of Greater New York. Mr. McCarter criticised the Public Service Commission of New York City on the ground that it had caused the collapse of the corporation of which Mr. Shonts is the head, and also because of its expense to the public. Mr. McCarter, like Mr. Shonts, then proceeded to express his approval of the conservative State Commissions "like that of Massachusetts."

Mr. W. Caryl Ely, Past-President of the Association and formerly prominent in connection with the Buffalo street railways, at once replied to Mr. McCarter. He showed that the Massachusetts legislation was not conservative, in the sense that is so often claimed, but radical. The Massachusetts Commissions have long had extensive powers over rates, routes and capitalization. He declared that the collapse of the New York City street railway aggregation was inevitable. The Public Service Commission merely pricked the bubble; and, said he, if New York had adopted radical ideas as early as Massachusetts did, the conditions that preceded collapse in New York would never have [illegible]en. Continuing he said:

> Gentlemen, this movement is not [illegible]ed to any state. It is sweeping over the whole w[illegible] The people are asserting themselves. We might as [illegible] seek to dam Niagara as to stop this.
>
> It is impossible to stop it. Deep dov[illegible] our hearts we know it is right; let us be men eno[illegible] to recognize it; let us cooperate with the people and [illegible] them understand that we are working together; be [illegible] with them and we shall find that they are not u[illegible]onable, but only want fair, square treatment.
>
> We have had trouble because there wa[illegible]tious fighting against proper measures, which woul[illegible] have been so drastic in some cases if the proper [illegible] had been shown, and the public service side was p[illegible]nted in the right manner. Let us deal with the peopl[illegible] in the most open way possible, and fare trouble and a[illegible]r troubles will disappear.

It is a pleasure to record that Mr. [illegible]y's frank statement was received with hearty [illegible]plause by the delegates. Deep down in his [illegible]rt, as he said, every man knows that the m[illegible]ment for public control is right. A few men [illegible]ve rolled up enormous fortunes, first by exp[illegible]ng street railway franchises and the public, [illegible] later by defrauding investors on a colossal s[illegible]e. Such men and those whom they control w[illegible] naturally lift their voices against all forms of State control or supervision, and particularly when such State control promises to be effectual in checking their plans for further similar work. But such men are in the small minority, even among those in charge of the actual operations of electric railways. Most operating officers, on whose ability and efficiency the character of street railway service inevitably rests, fully appreciate the necessity that public control in some form should be exercised. Such control does not—as is claimed—check real enterprise and initiative and block engineering work. Instead, it fosters and protects it. The corporations where the honest and efficient and enterprising engineer or superintendent finds no reward for ability and no chance of promotion are the corporations in which graft rules supreme from the top downward. Hence it was that while Mr. Ely's remarks may have been distasteful to some street railway magnates, the operating officials at the Atlantic City Convention gave them hearty approval.

LETTERS TO THE EDITOR.

The Proposed Ohio River Reservoir System.

Sir. Referring to the discussion which has been going on in your paper and elsewhere on the matter of reservoirs for improving the Ohio River, etc., and referring particularly to an editorial in your number of Oct. 8, 1908, I obtained the impression from this editorial that you were in favor of stopping all construction work on the locks and dams on the Ohio River until "the careful and comprehensive studies advocated by Mr. Leighton" could be made. I hope I read wrong, for it would seem a great pity for a journal of your standing and influence to advocate such a course.

I do not believe that Mr. Leighton or any one else advocates improving the Ohio River by reservoirs alone for the upper 300 miles, but all agree that locks and dams will be needed for that section, although Mr. Leighton contends that a few of these might possibly be omitted. It is improbable that they could, but even so, it would be the omission of one or two isolated dams, while a regular flow would have to be maintained in that stretch of river. This would probably not compensate for the money saved on the dams. At all events the difference would not be much. This being true, why should not this part of the work proceed without delay? It includes 28 or 29 dams, all told, and is absolutely independent of the remaining 25 or 26 dams. If any one desires, omit such dams as may be considered doubtful but proceed with the rest. Before this section is completed sufficient studies can be made to determine whether the present plans should be changed for the lower river or not, but in the meantime let no obstacles be placed in the way of this much needed improvement.

You refer in your editorial to the assistance the waterways would get if the questions of water storage, power development, and flood prevention should induce the municipal governments of Pittsburg, Louisville, Cincinnati, etc., the legislators of the Ohio valley States, etc., to demand a comprehensive improvement of this river for purposes not only of navigation but the other matters referred to. I do not believe from the present feeling and beliefs exhibited by the people of the Ohio valley, as well as the entire country, that it will be

necessary to obtain this assistance before this waterway is completed. Because the work of improving the Ohio River has gone on for 80 years without very hearty support from Congress does not argue that water storage, power development, and flood prevention are needed to get that support. One might as well argue that because they have done nothing in the past 80 years to help navigation legislation you could not expect them to do anything in the future to help it. Either argument is unsound. Conditions have changed. With the assistance of water storage, power development, and flood prevention, or with the assistance of anything else, undoubtedly more money would have been spent on the Ohio River in the last 80 years, with what results we can only conjecture, but it is also true that more would have been accomplished on the Ohio River if the present ideas on waterways had prevailed for the last 80 years.

I repeat, I hope I was mistaken in thinking you desired a complete cessation of Ohio River work until "careful and comprehensive studies" could be made. A good many have been made in the last 80 years, and if the work be stopped again, now since it seems to have gotten up some momentum, the delay will mean not one of a month nor yet of a year; it will mean a delay of a good many years. Very respectfully,

F. W. Altstaetter,
Captain, Corps of Engineers,
Assoc. M. Am. Soc. C. E.

U. S. Engineer's Office, Wheeling, W. Va., Oct. 13, 1908.

[We have not even hinted that in our opinion the improvements to navigation in the Ohio River now in progress ought to be stopped for any purpose whatever. We simply urge and continue to urge that the Ohio River problem, as well as the problems of other streams of the country, be considered in a broad and comprehensive manner, instead of from single, narrow and often isolated viewpoints. Navigation is not the only use to which the water of the Ohio drainage basin can be put, and we can see no reason why propositions for a broader view of the possibilities of that and other streams should not be fully investigated.—Ed.]

Further Examples of the Injury of Concrete Subject to Tidal Influence.

Sir: I was greatly interested in your article on the "Decomposition of Concrete in Sea Water" in your issue of Aug. 27, 1908, p. 238, as I had a very similar experience during the construction of a piece of work in Portland, Me., although not to such a marked degree, or of as serious a nature as indicated by the illustrations in your article.

In August, 1906, the abutment concrete for a bridge under construction at Portland, Me., was placed. This concrete was placed wet, so wet that the men working in it would sink up to their knees; it was mixed in the proportion of 1:2½:5 using Portland cement, a good local sand and run of crusher stone up to 2½ ins. Great care was taken to spade the concrete back from the forms so as to eliminate honeycombing on the face, and the work as a whole was of a very good nature. The tidal range at this particular point is about 9 ft. The concrete base of the abutment stopped at + 8 (low water being datum), the rest of the structure being granite ashlar. The concrete base is entirely covered by a protective filling of sand which in turn is protected by a granite block paving or riprap. Immediately after the construction of the abutment, the protective filling of sand was placed, but severe weather set in before the paving could be laid, and as a consequence a great deal of the filling was washed away by the winter storms thus exposing the concrete to the action of the tide and elements.

The winter of 1906 and 1907 was a particularly cold and severe one, and ice collected to a great thickness on and around the work. When the spring thaws came and after the ice had left, it was noticed that the concrete was decomposed and scaly. All sharp corners were gone and the concrete rounded. Careful investigation with a hammer and drill showed, however, that the decomposition only extended to a depth of about 2½ ins. and that the general body of the concrete was good. It was also found upon removing some of the sand filling still in place that the concrete which had been protected by it was still in perfect condition; one inch below the surface of the sand the concrete was so hard and perfect that the grain of the form boards could be plainly seen.

It was determined to conduct a series of experiments to ascertain if possible the cause or causes of this decomposition, as follows: A set of standard briquettes (1:3) were made, mixed with fresh water; half of these were stored in fresh water and half in salt water in the laboratory after being 24 hours in moist air. A second set were made mixed with salt water and stored in the same way, and a third set was made mixed with fresh water, one-third of them being stored in the laboratory in fresh water, a second third buried in the sand of the filling about a foot below the surface, and the rest placed in a crate fastened to a pile at about half-tide elevation so that they would be submerged and exposed to the air alternately and for about equal periods of time.

A set of three 12-in. cubes were mixed in the laboratory, one of these was dropped to the bottom in about 10 ft. of water, the others left on the ground. Lastly a set of blocks about 4 × 4 × 12 ins. were made of samples of concrete taken from the large buckets while on their way to other parts of the work so as to get the practical concrete and to eliminate all laboratory conditions. These blocks were about equally divided between 1:2:4 and 1:2½:5 concrete. Lots of these blocks were allowed to dry in air for periods of one, six and twelve days and were then put into crates secured to piles at the mean tide elevation. All of this work was done in the spring of 1907.

The briquettes of the first two cases, i. e., those mixed with fresh and salt water and stored in fresh and salt water in the laboratory, were tested in the machine at one, three and six months and little or no difference found in them. In the briquettes of the third class, i. e., those made with fresh water and stored in the laboratory, buried in the filling and stored at mean tide, the briquettes stored in the laboratory and those buried in the filling showed little or no difference up to the sixth month, but those briquettes left in the fill for a year test showed swelling and checking after about ten months. The briquettes stored in the crate at mean tide disintegrated entirely in about three months and at no time could a test be made with any of them.

The 12-in. cube was removed from the bottom of the river after being submerged for nearly a year and was found to be in perfect condition, as were also the two cubes left lying on the surface of the ground. During the winter of 1907-1908 all these cubes were placed on the mud flats at about half tide elevation, but as this winter was very mild and the period of observation short after placing the cubes no change was noticed in them.

The 4 × 4 × 12-in. blocks retained their sharp edges, and remained in perfect condition throughout the summer (1907), but began to disintegrate with the setting in of cold weather, and before the winter was over had crumbled to mere shapeless masses.

It may be of interest to note that the concrete foundations of several piers which were normally entirely submerged (being built to 0) were carefully examined both at the low run of spring tides and lower down with the aid of a diving suit, and were found to be in perfect condition after having passed through two winters.

I regret very much that I am unable to give actual figures and dates, but unfortunately a lot of data which I had collected and prepared on the subject was destroyed by fire and I have had to draw on my memory and a few general notes.

The conclusion which I have arrived at as a result of the observations made are: (1) Concrete is affected by salt water only in cold weather and then only in such portions as lie between the tidal ranges, and which come into contact with the water. (2) That the decomposition is due to alternate freezing and thawing, the water entering the concrete at high tide and freezing when the tide recedes and exposes the surface to the cold air. The water expanding as it freezes loosens the surface of the concrete. When the concrete is again submerged the water in the concrete thaws and a new supply enters the enlarged pores and extends a little deeper into the mass. This operation is repeated at every tide and gradually works into the mass. (3) It is perfectly safe to use concrete in salt water when it will be entirely and perpetually submerged.

Thanks are due Prof. Wm. H. Burr, who was consulting engineer on the work in question, for advice during the tests. Thanks are also due Mr. H. U. Fuller, who was my assistant and conducted the laboratory experiments.

Tyrrell B. Shertzer,
Assoc. M. Am. Soc. C. E.

57 West 111th St., New York City, Oct. 14, 1908.

[Since the article in our issue of Aug. 27 was published, a member of the staff of this journal has made an examination of various concrete sea walls and other structures at the Brooklyn Navy Yard. It was found that the disintegration of concrete between high and low tide is going on there nearly or quite as extensively as in the structures illustrated in our former article at the Charlestown Navy Yard. The cause assigned is the same as that given in the previous article and quoted by our correspondent above, viz., the freezing of the water in the pores of the concrete during the intervals between high and low tide. It will be seen that this cause would operate just the same in fresh water as in salt water. In fact the fresh water would freeze and thaw more readily than sea water. It is the daily tidal range resulting in constant freezing and thawing, therefore, that is the governing factor in causing disintegration, and the fact that the water is salt instead of fresh has nothing to do with it. Concrete exposed in any other way so as to be alternately wet and dried at frequent intervals where the temperature ranges below the freezing point might be expected to disintegrate in similar fashion.

It occurs to us that if the cement facing mortar, or, better yet, all the cement used in the concrete laid above the low water mark were made thoroughly waterproof either by some of the patented compounds or by the admixture of clay, as proposed by Mr. Gaines, it might be feasible so thoroughly to exclude the water from the pores of the concrete that disintegration would not occur. We trust that some of our readers will undertake experiments or actual construction along these lines and report the results.—Ed.]

INEXPENSIVE CIRCUIT BREAKER FOR SMALL MOTORS.

By J. C. McQUISTON,* Assoc. Am. Inst. E. E.

Circuit breakers of the common types are too expensive for use with motors in the smaller installations. For this reason fuses are often used, in spite of the inconvenience of replacing them when blown, and although fuses are in many cases dangerous as well as expensive and troublesome to maintain. It is not an infrequent sight to find a blown out fuse replaced by so heavy a wire that it could burn out only with a current which would severely damage the apparatus it is supposed to protect.

The general use of circuit breakers has been limited because of the first cost of the installation. In order to provide a breaker which shall be able to compare in price with enclosed fuses, the Westinghouse Electric & Mfg. Co. has developed the small carbon-break circuit breaker, known as Type F, shown in the accompanying illustrations. The circuit breaker is of compact and neat construction, suggesting the appearance of a cartridge fuse. The tripping device is inside the movable arm, which may also be tripped by hand with the small insulating handle shown in Fig. 1. In addition, an auxiliary magnet coil may be attached to provide for tripping the switch from a distance, as is required in connection with automatic limit switches on machine tools.

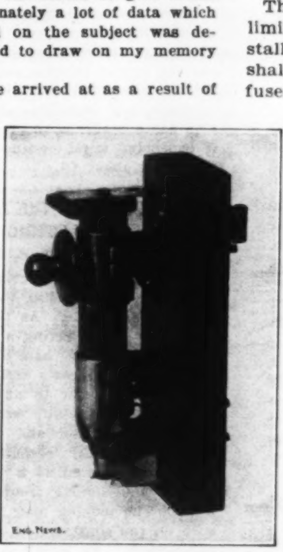

Fig. 1. Closed Position.

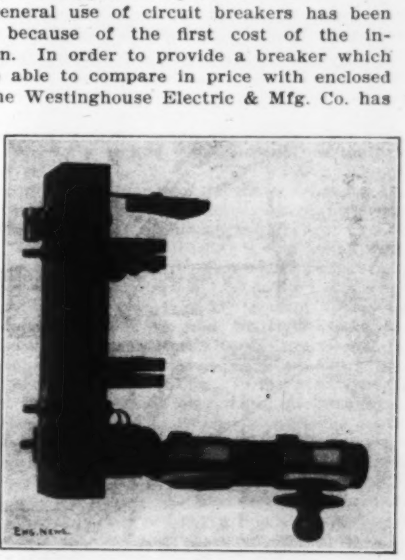

Fig. 2. Tripped Position.

FIGS. 1 AND 2. CIRCUIT BREAKER FOR SMALL MOTORS.

There circuit breakers are made in four sizes for 12½, 25, 50 and 75 amperes. Each has an operating range of from 80 to 160%; that is, the

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tripping device may be set for any current within these percents of the rated capacity. Adjustment is made by a knurled nut, which may just be seen at the lower end of the arm in Fig. 1. These breakers are made in single pole types for direct current up to 250 volts and alternating current up to 440 volts, and are approved by the National Board of Fire Underwriters.

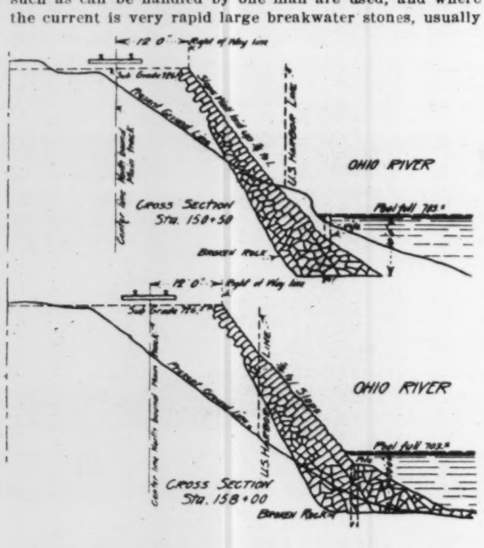
The standard circuit breaker is mounted on a porcelain base, similar to the mounting of a fuse, with all the connections on the face of the porcelain to permit its being placed directly on the wall. However, it is also supplied for switchboard and control tablet work where the connections are made on the back. Two screws are provided for mounting under these conditions. The outfit as a whole takes up practically no more space than an enclosed fuse of the same capacity.

PROTECTION OF RAILWAY EMBANKMENTS FROM THE EFFECT OF HIGH WATER BY RIPRAP OR OTHERWISE.*

PITTSBURG & LAKE ERIE R. R.—Riprapping banks on this road is a very important matter, as this road runs close to the banks of the Mahoning, Ohio, Youghiogheny and Monongahela rivers at several points between Youngstown on the Mahoning River, New Haven on the Youghiogheny River, and Brownsville on the Monongahela River, for a distance of 165 miles along these rivers.

At some points where riprapping is required and the tracks are far enough away from the harbor line to permit, the riprap is done by throwing the stones over the bank, letting them roll or slide down, making a slope about 1 on 1½, slope varying in thickness from 2 ft. to 4 ft. For this work quarry spalls are used or small stone such as can be handled by one man, and in some cases furnace slag, which becomes hard from the effects of the weather and makes very good riprapping, costing from one to two dollars per square yard. At points close to the harbor line stone such as can be handled by one man are used and laid in place by track laborers on a slope of 1 on 1, varying in thickness from 2 to 3 ft., costing about $3 per sq. yd. The accompanying figure shows riprapping where stones are laid in place along the banks of the Ohio and Monongahela rivers at Pittsburg.

In riprapping piers and abutments of bridges, in some cases where the current is not very rapid, small stone such as can be handled by one man are used, and where the current is very rapid large breakwater stones, usually



Riprapping of River Banks Along Line of Pittsburg & Lake Erie R. R.

dropping them around the piers or abutments, allowing them to find their own bearing. In all cases the large breakwater stones filled in with small stones are preferable, to fill up the crevices between the large stones and make the riprapping as compact as possible to prevent any washing.

NORTHERN PACIFIC RY.—On most waterways of the railway through the prairie country of North Dakota, boulders are used which can be picked up on the prairie and loaded on cars for $1 per cu. yd. and placed for 75 cts. per cu. yd. Stone is used for protection of banks from wave wash where permanent protection is required. For temporary protection in times of occasional high water sand bags and fascines are placed.

Portable snow fence is also used in emergencies. This fence is made in panels 16 ft. long and when placed along the bank will break the force of the waves.

At one place where a mile of track is exposed to occasional wave wash, the banks have been sodded, but there has been no high water there since the banks were sodded, so it cannot be said what the benefit will be; it is believed it will give good protection. At the crossing over the Missouri River there has been all kinds of trouble from bank cutting for approximately two miles above the bridge. The bridge itself is protected by dikes built of piles, fascines and rocks. For the protection of banks above the bridge dikes were built of mattresses composed of willows and stone and held in place by piling. Most of this work was done by the government, as the cutting of the banks endangered Mandan on the west side of the river and would also have destroyed the harbor for boats at Bismarck on the east side of the river.

ST. LOUIS SOUTHWESTERN RAILWAY CO.—Several methods have been used for protecting river embankments on this line from caving, the principal difficult streams being the Mississippi, Arkansas and Red Rivers. One of the first methods is to first slope embankments to pitch of 1 on 3 and drive piling at toe of slope about 50 ft. apart; then weave mattress of willow of sufficient length so that it will lay from toe of slope out into river about 50 ft. Mattress is then sunk with rock and placed in proper position and the entire bank is then riprapped with rock all the way and about ten feet at the top of bank, so that the high water cannot cut in behind it. It will cost approximately $8 per running foot of embankment.

Another method has proven very effective. Deflecting dikes are driven, piles being driven about every 8 ft. apart, dikes spaced about every 30 ft.; 2 × 6-in. planks are spiked onto piles about 6 ins. apart from the top of piling to bottom of stream. These deflecting dikes will collect the debris and the chambers will gradually fill in and form a bar. This method is effective in case of very rapid currents and will cost approximately $6 per lineal foot all complete.

There are other methods being used, some of them being quite effective, as, mudrafts and hollow fascines.* The latter are constructed out of willows and poles, then put into proper position and anchored. They will gradually fill in with sand and silt from high waters and sink in place, and embankment usually fills in behind it. It also has a tendency to check the current. However, this is expensive work, costing $9 per lineal foot. The mudrafts cost about $6.

*Extract from Committee Report to the Association of Railway Superintendents of Bridges and Buildings, Annual Meeting, Washington, D. C., Oct. 20-22, 1908.

APPLICATION OF THE THEORY OF THE CATENARY TO ELECTRIC RAILWAY WORK.†

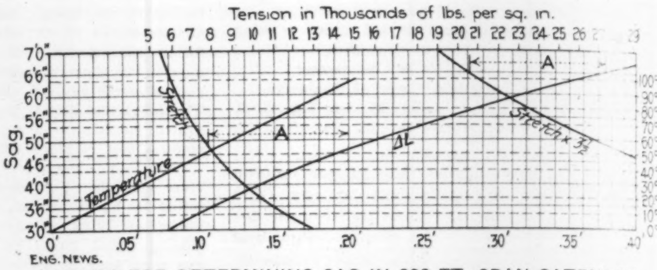
By R. L. ALLEN.‡

The term "catenary construction" has been applied to a method of suspending the trolley wire by hangers from a messenger cable. As this enables the use of a steel messenger cable having a unit working strength of over three times that of hard drawn copper we can have longer spans, fewer supports and a contact wire which is practically level. But to obtain these advantages the design must be carefully worked out in every detail as the strains are greater and the construction more complicated. In many respects an overhead contact wire may be considered as a track, the same qualities being desired and similar troubles met with as in the track work. The moving load is, of course, the upward pressure on the construction exerted by the trolley wheel or pantagraph. As in a track, it is desirable to have the contact wire slightly elastic in order to cushion the effects of the moving load. To obtain this cushioning effect uniformly at all points is one of the difficulties met with; the other is to take care of the expansion and contraction of the copper trolley wire due to change in temperature.

The strains due to wind and sleet are the least of the difficulties encountered, and can be readily taken care of with the materials at hand. In this respect it may be noted that while a span of about 300 ft. between supports is the limit at the present time, it is possible to use much greater spans without exceeding the safe working strength of steel cable. The question of the lateral swaying of the trolley is not so important as it looks on paper and may be taken care of by pull-offs. The supports may be wooden or steel poles, span wires, or steel bridges, each of which has its advantages and disadvantages, depending to a certain extent on local conditions. In general the use of long span[illegible] desirable, especially when a high voltage is used on [illegible]rolley, reducing the number of insulators to be [illegible] care of. This point applies where a steam traffic [illegible] be maintained on the same tracks, as the exhau[illegible] liable to cause trouble with the insulators.

Where the foundations are in soft groun[illegible]dges have the advantage in that each structure is [illegible] in itself owing to the wide base. On the other h[illegible]here are places where the use of brackets may be [illegible]sary because of obstructions on one side of the [illegible]t-of-way. Where more than four tracks are to be c[illegible]d a span wire is probably the best solution, althoug[illegible] involves either a guyed pole or very heavy foundat[illegible] In certain parts of the country where good woo[illegible]oles are cheap and readily obtainable, they will be fo[illegible] to reduce the first cost, although the saving is not a v[illegible] large per cent. of the total cost of the overhead cons[illegible]on.

It is suggested that there may be advan[illegible] in the use of long spans through city streets wh[illegible]here are usually great objections to frequent poles. [illegible] writer sees no reason why spans of 300 ft. or even more may not be used, especially where the line is straight. A construction of this kind would present a handsome appearance and would not be so liable to be cut in case of fire. The cost should not much exceed that of the usual 100 ft. span construction, as the cost of steel poles does not increase in proportion to their strength.



CURVES FOR DETERMINING SAG IN 300-FT. SPAN CATENARY.

The loads to be considered in preparing designs, are the dead weight, sleet and the wind load. Sleet is generally assumed at ½-in. thick on all cables. The wind may be assumed at 1 lb. per running foot of cable, as being well on the safe side. With these loads the structure should be so designed that the safe working stress is not exceeded. This should be about two-thirds of the elastic limit for steel, one-fourth of the ultimate strength for wood. In the writer's judgment, hard drawn copper may be stressed up to about 30,000 lbs. per sq. in. under these conditions and an excessive load will cause it to stretch instead of breaking.

In stringing the messenger cable it is desirable to adjust it for sag before the weight of the trolley and hangers is put on. In order to do this the elasticity of the cable must be taken into consideration. The calculations are rather complex, involving a long cubic equation and, in order to obtain a quick method for practical use, the writer has worked out the graphic solution shown in the accompanying figure. This is not original, being based to a certain extent on methods suggested by Mr. H. W. Buck, of the Niagara Falls Power Co., and also by Mr. Harold Pender.

By this method we find the true unstressed length of the cable by comparing two curves, one of which expresses the stretch of the cable under its own weight for various sags; the other, the difference in length between the true parabola and the chord between the points of support. The curves for stretch are derived as follows:

The center strain in any suspended cable is,

$$\frac{W L^2}{8 d} \qquad (1)$$

Where W = load in lbs. per running ft.
L = span in ft.
and d = sag in ft.

By substituting in this the weight of a square inch of material one foot long, we obtain, for steel cable, the stress per square inch.

$$P = \frac{L^2}{2.35\, d} \qquad (2)$$

and for copper

$$P = \frac{L^2}{2.08\, d} \qquad (3)$$

The stretch is

$$S = \frac{L P}{M} \qquad (4)$$

where "M" is the modulus of elasticity.

Combining (2) and (4), the stretch of a steel cable due to its own weight is

$$S = \frac{L^3}{2.35\, d\, M} \qquad (5)$$

and for copper cable

$$S = \frac{L^3}{2.08\, d\, M} \qquad (6)$$

Equations (5) and (6) are close approximations.

*See article by Mr. C. H. Miller on the David Neale system, p. 436 of this issue.

†From a paper presented at the convention of the American Street and Interurban Railway Engineering Association, Oct. 12-16.

‡Engineer, Archbald-Brady Co., Syracuse, N. Y.

The length of a parabolic curve for a span "L" is

$$L + \frac{8\,d^2}{3\,L}$$

and the difference between the chord and the curve is

$$\Delta L = \frac{8\,d^2}{3\,L} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

In the figure the sag is plotted on the vertical and the stretch on the horizontal scale. The straight line represents changes in length due to temperature. The point where the curves cross is that at which the cable will sag if its original unstressed length is the same as the span. Thus a steel cable 300 ft. long, strung between supports 300 ft. apart, will sag down 3 ft. 10½ ins. under its own weight. The horizontal distance between the curves (A) represents the difference between the unstressed length of the cable and the chord between the points of support. For sags below the point of intersection of the curves the unstressed length of the cable is less than the chord, above this point greater than the chord. Where an additional load is put on the cable, as, for instance, the trolley wire and clips, we can express this load as a multiple of the weight of the cable itself and the stretch will be increased in proportion. In the case of a certain single catenary the messenger supports a dead load of 3½ times its own weight and has a net sag of 6 ft. 6 ins. By plotting a new curve for stretch from the original, which may be done by the dividers or by direct multiplication of the abscissae at two or three points, we can obtain the new position of the cable since the horizontal distance "A" between the curves will remain constant—in this case at 0.09 ft.

For instance, if it were desired to string a messenger so that it would have a sag of 6 ft. 6 ins. with an additional load of 2½ times its own weight, it should be strung to a sag of 4 ft. 9½ ins. In a similar way the effects of temperature may be ascertained. Since any variation in temperature affects the true length of the cable, we must add or subtract this from the distance "A" and then find the point between the two curves to which it corresponds. If, in the example above, it were desired to obtain the effect of a drop in temperature of say 50°, we find this will shorten the cable 0.10 ft. The algebraic sum of +0.09 ft. and —0.10 ft. is —0.01 ft. and we find the curves are —0.01 ft. apart at 5 ft. 10 ins. sag. It will be noted that the elasticity of the cable tends to reduce the effect of the additional load and of the change in temperature. In the former case the fact that the load is multiplied by 3½ does not increase the strain in proportion and in the latter case the sag does not vary as much as might be expected.

As the stretch is a direct function of the stress per sq. in., this can be determined also by reading the scale at the top. The normal stress per square inch in the example given above at a sag of 6 ft. 6 ins. would be 20,500 lbs.

In preparing these curves the value of "M" for steel is taken at 22 × 10⁶. The value commonly used is 29 × 10⁶, which is no doubt correct for a steel bar but it does not take into consideration the fact that in a stranded cable there is a tendency for the wires to draw together under stress, which causes the cable to increase in length more than would a solid bar of like cross section. The modulus 22 × 10⁶ is derived from several tests of steel cable, the stretch being measured on a length of 100 ft. in order to reduce the probability of error. The pull was measured by a dynameter which was checked before and after the tests by lifting a pile of steel beams of known weight.

As regards the raising of the contact wire from the upward pressure of the trolley, some observations taken from a catenary trolley of 300 ft. span may be of interest.

The net sag of the messenger cable at that time (in winter) was 5 ft. 8 ins., the contact wire being cambered 10 ins. at the center, and was very tight; the hangers were spaced 10 ft. apart. A scale was applied to the trolley at 5 ft. intervals along the span and lifted until it registered 25 lbs. The net rise of the trolley was then measured. This increased gradually from ¼-in. under the bridges to 2¾ ins. at the center of the span. It may be noted that there was practically no difference between the stiffness of the trolley at the hangers and at a point midway between them.

The change in length of copper due to changes in temperature is one of the greatest difficulties in the maintenance of overhead work. A drop of 100° in temperature will cause a copper bar to contract approximately 1 in. for every 100 ft. of length. If it be restrained at the ends, this will mean an additional stress of 2,500 lbs. in a 0000 trolley. In span wire construction this is partially taken care of by the variation in sag of the trolley wire. In catenary construction where the trolley is supported at short intervals there is no chance for the trolley to take up the slack by sagging, consequently it is liable to become very slack in warm weather. For this reason the writer believes that unless there is some counterweight devised for maintaining a constant tension on the trolley, the hangers should be spaced not closer than 20 ft.

A system has been developed on the continent consisting of a single catenary with an auxiliary messenger which is parallel with the trolley and about 3 ins. or 4 ins. above it. This secondary messenger is hung at intervals of about 30 ft. by hangers from the supporting cable, and supports the contact wire by sliding clips located about 10 ft. on centers. The trolley wire is kept at a constant tension by counterweights located at long intervals. This construction also provides a practically uniform cushioning effect, as the trolley clips are very light and slide up and down on the secondary messenger. It remains to be seen whether this complication is necessary and whether practically the same results cannot be obtained by a development of the single catenary system on the lines suggested above, as follows:

(a) The use of a light plow steel messenger cable strung to a small sag. This will allow full advantage of the elasticity of the material.

(b) The hangers themselves should be as light and flexible as is consistent with strength and durability. This will tend to prevent sparking at the points of support.

(c) The hangers should be spaced 20 ft. or 30 ft. apart to take care of the expansion and contraction.

(d) There is no reason why spans of 300 ft. or more cannot be used.

RAILWAY MOTOR CONTROL.*

By WILLIAM COOPER.†

INTRODUCTION.—The use of an electric motor for any purpose demands the interposition of some kind of controlling apparatus in the supply circuit with the motor. The function of the control apparatus is to regulate the speed or change of speed of the motor shaft as well as the turning force. The amount and complication of control apparatus necessary for any given case depends upon the kind and size of motor to be controlled and the results to be accomplished. A desk fan motor, for instance, may be started by a simple snap switch, but if it is desired to regulate the speed of the motor some mechanism more complicated will be required. Motors of quite large power, however, can be started successfully by a single switch when connected to certain kinds of load if the characteristics of the motor are right.

In practically all the motors used for railroad work there is a fixed relation between the two elements that constitute the energy input to the motor and the two elements that compose the energy output. The turning effort is a function of the current input, and the speed is a function of impressed pressure. From this it would seem necessary to provide means for regulating both the current and pressure or voltage. But, as it is the voltage that produces the flow of current, it is only necessary to regulate the voltage. This point must be kept constantly in view in considering any control problem. The turning effort of the motor is the function that is to be controlled, and, as this depends on the motor current it is evident that the current is the element that must be regulated. Under any given condition the amount of current flowing is determined by the impressed voltage. It is, therefore, necessary to control the impressed voltage to regulate the turning effort.

The desideratum of electric motor control is to make the rate of change of pressure during acceleration absolutely constant. There are but few devices of practical application that fulfill this condition. A water rheostat used in connection with a direct current motor and an induction potential regulator in connection with an alternating current motor might be said to fulfill this condition.

In practically all the apparatus used to control railway motors the voltage is changed in steps or increments. From the very nature of their construction this is true, as the connections are made with a certain limited number of switches. These switches may be either a set of contact fingers in conjunction with a revolving drum or consist of separate and independently operated switches. Since it is necessary to increase the impressed voltage in steps or increments, the value of and the rate of application of these increments constitutes the problem of control in any given case.

Consider first a motor at rest. The voltage that can be impressed on the motor at once without giving an excessive flow of current and consequently an excessive torque is determined by the inherent characteristics of the motor. This is easily determined, but the value of the torque that can be used is not so easily determined. From the control standpoint it is desirable to make the first application of current as large as possible as well as for each succeeding step.

The average rate of acceleration that can be maintained without discomfort to passengers depends very largely upon the fluctuations. An acceleration of 5 mi. per hr. per sec. can be maintained without discomfort to the passengers, provided the rate is constant or nearly so. As it is manifestly impossible to keep the rate constant with a control apparatus in which the change in impressed voltage on the motors is made in steps, the problem is to ascertain the limit of fluctuation allowable. This limit seems to be more a matter of change of rate than a question of average rate—that is, a certain change in rate will cause an uncomfortable jerk, no matter what the average rate may be. If the rate of acceleration is 3 mi. per hr. per sec. and it is instantly changed to 4 mi. per hr. per sec. there will be an uncomfortable jerk.

In designing a control for any given case, this is the first point to be considered and the total number of steps in the apparatus adjusted accordingly. As a general proposition the number of steps must be such that the change in rate of acceleration when changing from point to point will not be greater than 0.6 mi. per hr. per sec. for passenger service.

Having determined the allowable fluctuations of current in the motors and from this the total number of steps in the whole sequence of acceleration, the next consideration is the method of obtaining these steps. In the control of direct current motors it is obvious that, starting with a constant line voltage, the impressed voltage must be regulated to a greater or less extent by inserting resistance in the circuit and cutting it out step by step. If more than one motor is used certain combinations of the motors may be employed.

In the control of alternating current motors it is not necessary to use resistance or to change the combinations of the motors, as a variable voltage is readily obtained by the use of a transformer with various taps brought out.

In making a determination of the increments of voltage to be impressed upon the motors during the period of acceleration the nature of the service has a very important bearing on the subject. As stated, if it is for the passenger service a certain change in rate of acceleration is allowable. This same variation is not at all allowable in freight service or where the question of adhesion or capacity of motors enters into the problem. In freight service the rate of acceleration is usually quite low. This is allowable, as the time consumed in acceleration is but a small part of the total time, for the reason that the full speed is low. Under freight haulage conditions the change in rate of acceleration must be measured in percentage of total drawbar pull rather than in miles per hour per second. The fluctuations of drawbar pull should not be more than 15%, and if it is desirable to get the maximum pulling power it must be even less.

Thus it is seen that in the use of electric motors for any kind of railway work some kind of control apparatus must be used to regulate the impressed voltage on the motors, the nature and refinement of which depends upon the kind of service.

GENERAL DESCRIPTION OF APPARATUS.—The number of different kinds of control apparatus used is even greater than the different kinds of motors. There are two distinct types that cover practically the entire field, commonly known as the drum type and the unit-switch type.

The marked distinction between the two types is that in the drum type the various combinations of circuits are made by a set of contact fingers arranged to make contact with a revolving cylinder having suitable segments arranged to connect the fingers together in certain combinations. The unit-switch type consists of a set of separate switches, independently operated by power. These switches perform the same functions as the contact fingers and drum segments in the drum type. As a matter of fact, the contact fingers and drum segments are nothing but switches. In the drum type the sequence of the combinations is controlled absolutely by the motion of the drum or cylinder carrying the contact segments, as it is obvious that during a given motion of the drum the contacts will be presented to the fingers in a certain order. It is also obvious that a reverse motion of the drum will make the combinations in an exact reverse order. In the unit-switch type the sequence of operations of the switches is usually secured by electrically interlocking the actuating circuits. This arrangement determines the order in which the control combinations are made, but it is not unusual to allow all switches to open simultaneously, no matter what the position may be. This is always the case when automatic acceleration is used and sometimes when manual control is used.

As already pointed out, a controller for an electric motor or motors is intended primarily to graduate the application of the line voltage to the motor during the period from standstill to the time when full line voltage is impressed upon the motor. If this is not accomplished with ease and precision, then one of the functions of the controller has failed. Another function of a controller is to make and break the circuits in changnig the combinations of the motors and in the final breaking of the circuit. If the controller does not accomplish this without serious deterioration, then it is a failure in another important function. If it fails in both these functions, then it is indeed a complete failure.

DIRECT-CURRENT CONTROL.—In designing a controller for direct-current work to fulfill the first condition there are two general methods followed—that of

*A paper presented at the convention of the American Street and Interurban Railway Engineering Association, Atlantic City, N. J., Oct. 12-16.

†Engineer, Westinghouse Electric & Manufacturing Co., Pittsburg, Pa.

plain rheostatic control and that of series-paralleling the motors. The first arrangement must of necessity be used when only one motor is employed and can be used when more than one is employed by connecting them in either series or parallel permanently. If the control is to be plain rheostatic, the main consideration is the number of steps to be used. This point is often considered more from the point of simplicity of construction of the controller than from perfection of operation. Since the fulfillment of both of these conditions is obviously impossible, a compromise must be made. The number of steps used should be regulated by the service conditions, but is usually made about the same for all kinds of service. It is safe to say that the number used is always less than desirable.

When two or more motors are used on direct-current work, it is desirable to arrange the motors, in some kind of series-parallel combination. The common method is to connect the motors in series with a certain amount of resistance and cut this resistance out leaving the motors operating in series with the full line voltage divided between them. In the case of two motors each motor will have half the line voltage and with more than two a proportionate part. It is a very simple matter to connect two motors in series with a few steps of resistance and then cut this resistance out. but it is not as simple to change the connections and get the motors in parallel especially if it must be done without any change of torque of the motors. There are several ways of changing the motor connections from series to parallel while the motors are in motion. There are three that have been used extensively. They are known as the "shunted-motor," open-circuit" and "bridging" systems. The last system is the only one that fulfills the condition of continuous torque on the motors, or in other words, is the only perfect system.

The shunted-motor system short circuits one motor, if there are two in series, first inserting resistance in the circuit to equal the volts drop on the motor short circuited. The motor short circuited is then connected in parallel with the other motor and the reinserted resistance cut out. The objection to this system is that at the instant of inserting the resistance in series with the two motors in series the torque of both motors is reduced. When the motor is short circuited there is no great change in torque as the one motor takes practically double the current of the two in series after the resistance has been inserted. Another objection to this system is the unequal loading of the motors. This is, however, of no great moment in service as the time of transition is relatively very short.

The open circuit system, as the name implies, opens the circuit to both motors and re-arranges the connections with the motors in parallel and in series with a certain amount of resistance. This system is obviously not as good as the shunted-motor system for the reason that the torque of the motors ceases entirely.

In the bridging system, a circuit is maintained through each motor throughout the whole period of acceleration and the torque of the armatures is kept practically constant. This result is accomplished by arranging the motors first in series and in series with a certain amount of resistance and then cutting the resistance out leaving the motors in series across the line. The resistance is then arranged in two groups and connected directly across the line with the middle point connected between the motors. This establishes two paths, one through the motors and one through the resistances, with a point of equal voltage of the two connected together. If the value of the resistances is such that the current flowing through the resistance is equal to the current flowing in the motors, the bridging connection between the motors and resistance can be broken without making any change in armature current. This system of direct-current control is so far superior to any other that it is the only one that should be given consideration. This is not only true with two motor equipments but is equally true when using four. The use of this system in connection with automatic acceleration gives results that cannot be attained by any other known system.

Controllers with an insufficient number of steps have been in use in so many different places and on so many different equipments that the users have come to believe that the conditions they impose are a necessity. As before stated the design must be a compromise, but let the compromise be such that the completed machine will reasonably fulfill the conditions.

The design of the resistance for direct-current operation plays as important a part as the number of steps. If the resistance is not properly designed good operation cannot be secured no matter how many steps there are in the controllers.

There are only two conditions of the motor circuit that affect the design of the resistance, the ohmic resistance including the motors and the counter electromotive force of the motors. The value of the resistance cut out on each step must be such that the increase in current will be the same for each step cut out. While the speed of the motor is low, the regulating resistance left in the circuit checks the flow of current. After the motor speeds up due to cutting out a portion of the resistance the counter electromotive force has a greater effect and the remaining resistance less.

ALTERNATING-CURRENT CONTROL.—In the control of alternating-current railway motors, the controller designer is not hampered by many of the limiting conditions of a direct-current motor. There must, however, be a limit to the increase of current in the motor per step. This condition is not, however, nearly as exacting as in direct-current operation, owing to what is commonly known as "rubber" in the circuit. It is of no advantage to series-parallel the motors as any number of voltages are easily obtainable. This at once eliminates the question of resistance losses and operating speeds. There are no resistance losses and any number of operating speeds are obtainable. There are two points to consider in regard to the arrangement of the motors. Arranging the motors in series reduces the volume of current to be handled as compared with the parallel arrangement but increases the voltage. The advantage of the smaller current is a reduction in size of all current carrying parts, which is more a matter of first cost and weight than one of maintenance or operation. On the other hand, the motor circuits as well as the control apparatus must be subjected to the higher voltage. Also the higher voltage current is more difficult to handle on the circuit making and breaking devices. This part of the problem is quite different from direct-current control. In direct-current work the motor and control voltage is fixed by the line while in alternating-current work the motor voltage is independent of the line and may be made anything that makes the best design.

The question of selecting the proper voltages for the different steps of the control is governed by the same limitations as in the direct-current. The increments of current per step must be kept within certain limits and should be the same for each step. There are three things that affect the increase of voltage per step to give an equal increase in current; the resistance of the circuit, the counter electromotive force and the inductive voltage. The resistance and counter electromotive force represents the energy or inelastic portion of the circuit, while the inductive voltage represents the elastic and non-energy portion. The combination of the two tends to keep down an increase of current due to an increase in impressed voltage. The energy component of the voltage and the inductive component are at right angles. That is, there are two forces acting at right angles, the result being that they are effective in resisting the impressed voltage in an indirect proportion to their value.

As in direct-current operation, no alternating-current control system is worth a moment's consideration in which the circuit is interrupted during acceleration of the motors. In alternating-current work the motor connections can be changed from one voltage to another by first connecting either a preventive resistance or a preventive coil across the two voltages. The value of this preventive resistance or preventive coil should be such that the value of the short-circuited current will be equal to or greater than the working current. One of the best methods of transferring the motor connections from one voltage to another, is by the use of small auto transformers having three connections. If the two ends of the coil are connected to two taps from the main auto and the center connected to the motors the impressed voltage on the motors will be that intermediate between the two connections to the transformer. This impressed voltage will remain the same irrespective of the amount of current flowing as the action is that of an autotransformer, there being no choking effect. In changing from one voltage to another, one connection is broken and re-connected to the next higher or lower tap than the one left remaining. While the one connection is broken there will be a slight reduction in impressed voltage due to the choking effect of taking the current through one-half of the coil. This drop in voltage with a well designed coil is small. The advantage of this arrangement over any in which coils or resistance are used for transferring, is that two switches are connected in parallel to carry the main motor current.

An elaboration of this scheme consists in using three such small auto transformers, two being connected to the main transformer and the third being connected to the two middle points of the others, the main motor current being taken from the center of the third coil. This arrangement reduces the size of the transformer switches still further as there are four in parallel for the main current. Also there is practically no drop in voltage when changing from one transformer tap to the next higher.

Another condition that is quite different from direct-current control is that every point is a running point. The apparatus used in making the combinations and connections of circuits is in all essential details the same for both alternating-current and direct-current operation. There are, however, some characteristics of the two currents that are quite radically different, the principal one being the magnetic field produced. An alternating current produces, of course, an alternating magnetic field. This alternating magnetic fiel[illegible]s the peculiar characteristics of inducing local cu[illegible] in any piece of metal that may happen to be wit[illegible]s range. The value of these local currents is very [illegible]ly controlled by the extent of this metal and are [illegible] materially reduced by dividing the metal into sm[illegible]arts.

In rupturing the circuit the magnetic blow[illegible]s useful. It is not, however, quite as effective on alt[illegible]ing-current as on direct-current, owing to the lo[illegible] currents in the metal parts of the circuit, which te[illegible]o throw the magnetic flux out of time with the cur[illegible]

Alternating current of necessity passes th[illegible]gh zero. This characteristic assists very materially [illegible] breaking the circuit and many drum controllers are in successful operation, without any blowout of any kind, handling heavy currents at from 200 to 300 volts. [illegible]re are even a few operating at twice that voltage. [illegible] characteristic is also shown in the comparativ[illegible]e with which a high voltage alternating-current [illegible]uit is opened under oil. The oil cools the arc, wh[illegible] breaks at the zero point. This is a very fortunate condition, as it is very difficult to break a high voltage circuit in the open air. An oil switch is practically inoperative in opening a direct-current circuit, but fortunately a direct-current circuit of any of the, at the present time, commercial voltages can readily be opened with a magnetic blowout switch.

AUTOMATIC ACCELERATION.—As the principal function of a control apparatus is to graduate the application of the voltage to the motors in such a manner as to maintain the current within certain limits it follows that it must be actuated at certain fixed intervals. This can be done automatically with far greater precision than is possible manually even by the best trained operator.

In operating railway trains there is one great object to be accomplished. That is to transport a given number of passengers or tons of freight a certain distance at a minimum expense, and within a certain time. As one of the principal items that make up the total expense is wear and tear or maintenance, it is obvious that anything that will reduce this item, without reducing the capacity of the system, will be an economy. The maintenance of rolling stock is directly affected by the manner in which the propelling power is applied. It needs no argument to show that there will be less wear and tear if the power is applied evenly and smoothly and at the proper rate than if it is applied at an improper rate and unevenly. The current in the motors regulates the tractive effort and this determines the mechanical strains put upon the driving mechanism. In addition to this the current in the motors determines the heating and deterioration. For any given service there is only one rate of acceleration and time of current on the motors that gives the minimum heating effect in the motors.

All these conditions have been long recognized by those in charge of railway equipment and there has been a demand for some device that would prevent abuse of the equipments by careless or unskilled operators. There are many careless operators but there are many more unskilled ones. On ordinary hand controllers, many so-called "auto-motorneers" have been applied. All these devices are operated on a time basis, that is, a certain time must be used in changing the controller from one step to another. This method, in itself, is a step in the right direction as it certainly limits the current input into the motors under certain conditions.

Automatic acceleration can be secured properly only by a current limiting device. There are no such devices applied to drum controllers. It may be possible to design such a device, but attempts in that direction have not thus far met with success. In the use of unit switches, that are separately power-operated, automatic acceleration can be secured by connecting the operating circuits through small contact making devices which are actuated by the main switches in closing and opening. By this arrangement the closing of some certain switches sets the actuating circuits for certain other switches, but these cannot close until the current-limiting device says that the current does not exceed the proper value. After the current has fallen to the proper value the current-limiting device closes the circuit to the switches and certain other switches will close, increasing the impressed voltage on the motors and increasing the current. This acts to lift the current limit and to stop the progression of the switches until the current again falls to the proper predetermined value. This produces a uniformity of action of the switches and a smoothness of operation that no operator can reproduce manually, no matter what his skill may be.

There are several modifications of this method of control that are adapted to certain special conditions. For instance, if a road has heavy grades and it is necessary to start on these grades, it will, of course, be necessary to set the current limit high enough to give the torque required on the grades. This may be too high for proper operation on level track and it may also be so high as to be detrimental to the motors if used continuously. One way of meeting this condition is to use a time-limit relay that will operate the switches the same as the

current limit, this time limit being set so that it only comes into action under the most severe conditions. Another is, in four motor equipments, to throw the motors all in series, thus, for the time being, doubling the current per motor. Still another way is to have a small push button or switch to cut the current limit out temporarily. This is operated to pull in one switch at a time until the point of hard pull is over. This arrangement is simple and is not open to the objection that the operator will use it at all times for the simple reason it is less work for him not to use it.

There is another method of connecting the current limit that is of considerable value in connection with direct-current roads, having a limited supply of power. If the current limit is connected in the trolley circuit, the acceleration will be at a constant current from the line irrespective of whether the motors are in series or parallel. It is necessary with this arrangement to accelerate with a larger current per motor with the motors in series than when using constant-motor current. That is, it is necessary to push the acceleration with the motors in series in order to give the same average. The advantage of this arrangement is that the fluctuations of power on the line are very much reduced. When using constant current per motor the demand on the line is, of course, twice as great when the motors are in parallel as when in series. By using constant line current the maximum demand on the line can be reduced from 25% to 35%. This point is of more importance than it may appear at first sight.

Practically all car equipments operating with automatic acceleration are of unit-switch type, but not all unit-switch control has automatic acceleration, although there is one type of unit-switch car control apparatus that is only used in this manner on direct-current work.

The advantages of automatic acceleration as applied to direct-current operation are equally as great as applied to alternating-current operation, although the question of fluctuation of line current does not enter into the consideration to the same extent. Some equipments are in operation on alternating-current using two current limits, one to limit the motor current up to a certain value of line current and then limiting by the line current.

MULTIPLE CONTROL.—Of all the different functions and characteristics of railway motor control, the ability to handle a number of different power units simultaneously is of vastly more importance than any other. It makes possible the fulfillment of service conditions that would be impossible without it. It is of as much importance to electric train service as the introduction of air brakes was to steam train service. It makes available the greatest inherent advantage of the electric motor for traction purposes, the subdivision of the power into small units without loss of efficiency. It makes available every wheel on every car for driving purposes as well as for braking, thus securing the maximum speed regulating facility.

There have been a great many different schemes proposed for accomplishing this result, but only a few have ever been put into operation. Almost any scheme that is correct in principle can be made to do the work no matter how complicated or intricate it may be. It is only a question of perfection of the mechanism and details. There are, however, certain conditions that must be fulfilled or the apparatus will fail. First, the question of safety must be as absolute as possible. There must be no possibility of false operations of the control apparatus, such that a train will start unintended, and the ability to cut the power off at will must be equally as certain.

To fulfill these conditions, the apparatus must have certain characteristics. A failure of any part to perform its proper function must be negative in its results rather than positive. This is a condition that is well recognized by all designers of automatic machinery. It is safe to say that "what can happen will happen." This is appreciated by no one more fully than by one who has been connected with the development of a system of multiple-unit train control.

As the operation of the apparatus on each car must be controlled by electric circuits carried from car to car, the integrity of these circuits must be maintained. It is not only necessary that these circuits be well and properly insulated, but that they be kept so separated at the working ends that no false circuits will be established. With a set of unit switches arranged for automatic acceleration, it is not very difficult to get the different circuits so inter-connected that a false circuit will be established from car to car. Some of these circuits are so much involved and are so difficult to trace that they are only discovered when several cars are connected together. The precision and safety with which the trains are handled on the roads using multiple unit control would seem to indicate that the difficulties above mentioned have been pretty thoroughly overcome.

In developing apparatus to meet the requirements of multiple control and automatic acceleration as set forth above, the engineers of the company with which the writer is connected have followed consistently and continuously certain well defined lines: (1) the operation of the control apparatus is entirely independent of the main power circuit; (2) maintaining relatively high pressure on all switch contacts; (3) low-voltage non-grounded circuits from car to car; (4) automatic acceleration; (5) all direct-current car equipments operated on the bridging system of control.

These features have been maintained in all the apparatus put into operation and as the term of service increases the value of them becomes more and more pronounced.

The value and advantage of operating the control apparatus independently of the main power circuit consists in being unaffected by any variations of line voltage and ability to operate control apparatus when the power is off. One of the advantages of this is that the motors may be "bucked" in case of an emergency. Also the control apparatus can be operated for inspection without power on, thus removing any possible chance to accident. These advantages and some others not mentioned, more than offset the trouble and disadvantage of maintaining the small storage battery used for the control circuits.

The question of switch pressure contact is under perfect control, as compressed air is used to operate the switches, thus making it easy to get any pressure required. The comparative heating with low pressures is excessive and often causes a welding together of the switch contacts. The principal advantage of the ability to get high contact pressures is that the switch can be made much narrower and a magnetic field of proper strength for blowout purposes can be more readily secured. With this construction, it is possible to make single switches of several thousand amperes capacity for direct-current operation. For alternating-current operation the capacity of a single switch has another limitation, that of secondary currents in the metal parts of the switch exposed to the action of the magnetic field used to blow out the arc.

The use of low-voltage, non-grounded circuits for the train line has two very great advantages over a high-voltage train line: immunity from short circuits and grounds, and the absence of sparking or burning at the master controller or interlock contacts; also, from an inspection standpoint, there is no danger of getting a shock from handling the current carrying parts.

THE OPEN-TANK METHOD OF PRESERVING TIMBER.*

By HOWARD F. WEISS.†

The purpose of this paper is to discuss briefly the history, theory and practical application of the open-tank or non-pressure process of preserving timber.

The successful impregnation of wood with preservatives without pressure was first brought before the public in 1867 by Prof. Charles A. Seely, a citizen of New York. The principles which Prof. Seely then described are in a large measure the same as those now accepted and employed. The general impression at that time that our timber supply was inexhaustible, coupled with the comparatively low price of lumber, caused Prof. Seely's process to attract very little attention. In fact, records show no trace of its commercial application and practically no progress was made with it until the Forest Service carried on a series of tests at the Louisiana Purchase Exposition at St. Louis, in 1904. At the exposition a number of different kinds of wood were treated by the open-tank process, and many efficient results were secured. These led to its more extensive study—a study which the Forest Service is still actively developing. A similar series of tests was carried on at the St. Louis Fair by the promoters of the Guissani process. The principles involved were in a large part identical with those of Seely. I believe there are two commercial plants in Italy in successful operation treating wood by the Guissani process. The Forest Service has carried on a large number of tests in various parts of the United States to develop the open-tank method. Different kinds of timber have been treated in cooperation with telephone, mining, lumber, railroad companies, etc., and enough information has been obtained to place it on a sound practical basis.

All wood is more or less porous and contains various amounts of air and water. If the wood is thoroughly saturated with water, no preservative can be forced into it. It is essential, therefore, in any preservative process to reduce the amount of moisture to a point where a satisfactory treatment can be obtained. In the open-tank method this is accomplished chiefly by air seasoning. The same means are also employed in a number of processes where pressure is applied. There is no doubt but that air-seasoned wood is in a better condition for treatment than green wood. The chief drawback to air-seasoning is that it necessitates a large storage yard and a tied up stock which is subject to a fire risk and accumulating interest. Moreover, demands of business sometimes make it imperative to cut the timber in the woods and ship it to the preserving plant for immediate treatment. In such a case no recourse can be had to air-seasoning. Again, if the timber is not properly piled and is held for a long period in a seasoning yard it is liable to decay, especially in certain portions of the South where the atmosphere is warm and damp. It is frequently necessary to devise some means whereby the wood can be quickly seasoned and the following methods are practised: steam seasoning, oil seasoning. Saturated steam is practically the only kind now used. Superheated steam is so difficult to regulate properly that the wood is in great danger of being charred and its use has now been largely abandoned. The chief objection to saturated steam is that it does not dry out the wood; it is effective only as a heating medium, and a vacuum must be subsequently applied in order to get the moisture out of the wood. If seasoned wood is subjected to saturated steam, it will take up water. When green wood is heated in oil at a temperature above the boiling point of water, it decreases in weight because the sap and water which it contains are vaporized and driven off. Its effect as a heating medium, therefore, is directly opposite to that of saturated steam. Few plants employ oil as a heating medium, but it seems highly probable that it will come into more general use. The chief difficulty at present is to drive out the moisture without affecting the physical properties of the wood. Oil-drying is used in the open-tank method to prepare green timber for the reception of the preservative. It takes considerably longer and it is more expensive to dry out wood containing 80% moisture than it is to dry out that containing only 20 or 30%. Seasoned wood, therefore, is recommended for the open-tank process whenever possible.

Wood is made up of a mass of united bodies called "cells." These vary in number, size, composition, form, density, etc., according to the character of the wood, or, more properly, the character of the wood depends upon these factors. The cells are bounded by cell walls composed chiefly of cellulose. All tests made thus far fail to detect the presence of creosote in cell walls. If this is the case, it can occur only in the cellular and intercellular spaces of the wood. In the open-tank process impregnation with a preservative is accomplished by heating the air and moisture in the wood and then cooling them. The cooling causes a vacuous condition which is destroyed by the entrance of the preservative. An illustration in which the figures are all approximate may serve to show this more clearly. A cubic foot of air-seasoned loblolly pine weighs approximately 35 lbs. This is made up of a solid (cellulose), liquid (sap) and a gas (air). Assume now that the air and sap are driven out of the wood by heating. The cubic foot of wood then weighs 30 lbs., and will be made up of 30% solid matter which cannot be impregnated; 70%, however, will be cellular and intercellular space, which, if completely filled with creosote, will give an absorption of 45.7 lbs. This may be termed the maximum theoretical absorption. In practice all of the air and water cannot be driven out of the wood by heating. Neither can a perfect vacuum be obtained by cooling. The maximum practical absorption, therefore, is always less than the theoretical absorption. An absorption of 38 lbs. of oil per cubic foot, or an efficiency of 83%, based on a theoretical absorption, has been obtained by the open-tank method with the species mentioned.

The resistance offered by the cell wall to the entrance of the preservative is a problem of great practical importance, and one which is not at present well understood. Sap wood can almost without exception be far more easily treated than heartwood. This resistance appears a distinct problem altogether from the density of the wood, and may be due to the lignification of the cell walls. Heart red gum, subjected to a pressure of 800 lbs. per sq. in., could not be penetrated, although this wood is by no means of a dense structure. In such cases, therefore, it seems very improbable that the application of pressure alone will assist the treatment to any appreciable extent.

It is safe to state that the sap wood of practically any species can be completely impregnated by the open-tank process. The amount of preservative injected per cubic foot can be varied without affecting the penetration. In other words, a "full" or "empty" cell treatment can be easily obtained. Tests made on loblolly mine props showed a penetration of 3½ ins., while the absorption of the creosote varied in amount from 6 to 18 lbs. per cu. ft. The amount of absorption is controlled largely by the degree and duration of the heating and cooling periods. If held for a long time in hot oil, and then submerged in cold oil until no further cooling takes place, the wood will be thoroughly saturated. If heated in hot oil and then submerged in cold oil for only a short period, the cells of the wood will be only partially filled with the preservative. A similar result can be obtained by heating, cooling and then reheating the oil and wood.

When it is desired to impregnate the wood with an aqueous solution, such as zinc chloride, it is first heated in oil and then submerged in the cold water solution. Poles cut from western yellow pine were treated in this

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manner in California and the zinc chloride penetrated to a depth of 4 ins. The absorption of dry zinc chloride varied from ½ to 2 lbs. per cu. ft. The amount of absorption was controlled by the strength of the solution and the duration of the hot and cold baths.

It can be seen that the open-tank process admits of a wide range of successful treatments for round timbers, such as posts, poles, props, etc. A mistake commonly made with sawed or hewn timbers, especially with cross ties, is that heartwood or some species unadapted to treatment is specified. It happens at present that the more abundant and cheaper woods are almost always the ones best suited to preservative treatment. In a great many cases these can be more advantageously used than the more expensive varieties. Tests made in Louisiana without pressure on heart long leaf pine ties showed the creosote had penetrated ½ in., which is a good treatment for this class of material. The heartwood of practically all species is very difficult to treat by any process, and in some the heart wood cannot be treated at all.

In all pressure processes all portions of the timber are given the same treatment; thus the top of a telephone pole or fence post gets as much preservative as the butt. It is well known that in many parts of the United States a top treatment is not necessary. In the open-tank process the whole pole, or only a portion of it, can be treated. This saves very materially in the cost of the preservative. Fence posts were treated in Alabama in which the butt portion was penetrated with creosote to a depth of 1½ ins., while the top was only given ¼ in. There is no good reason why the top of a post should be preserved longer than the butt. The open-tank process enables the treatment to be adapted according to the conditions to which the wood will be subjected. This must, in many cases, be acceded to be a distinct advantage over any pressure process.

There are at present two general types of open-tank plants in use. In one the wood is moved during the baths, while in the other the preservative is moved. The former is the simpler type and the one best suited to the treatment of fence posts and other small timbers where a cheap plant is desired, or when only a small amount of timber is to be treated. These plants may be built for as little as $5. Those commonly used by the Forest Service cost from $35 to $180 each, and have a capacity of from 50 to 200 posts per day. When large, heavy timbers, such as cross ties, mine props, poles, etc., are to be treated, it is cheaper to build a more expensive plant and to move the liquid rather than the wood. These plants are largely patterned after the pressure plants, but can be built at a much less cost on account of the lighter material and machinery used in their construction. A plant, including a treating cylinder 50 ft. long and 6 ft. in diameter, will cost about $8,000. Plants of this type consist of a horizontal cylinder of ¼-in. steel, with swinging doors locked by bolts. A small dome is fitted on the top of the cylinder and connected with a surface condenser. The vapors which pass off from the wood and oil during the hot bath are run through the condenser and can be turned back into the treating cylinder or into a waste. The cylinder is fitted with a track for running the cars in and out, with steam coils for heating the oil, and with thermometers for recording its temperature. One or more closed measuring tanks are built either directly over or to one side of the treating cylinder, so that the preservative can flow by gravity. These tanks are fitted with a gage which shows the absorption of the preservative. A receiving tank is built in a pit so that the oil may run from the treating cylinder into it by gravity. It is then pumped back into the measuring or storage tanks.

To recapitulate: Practically all kinds of wood adapted to preservation can be satisfactorily treated by the open-tank process in a wide variety of forms, such as ties, poles, piles, posts, shingles, props, etc. The process can be varied so that the cells of the wood can be thoroughly or only partially filled with the preservative, thus giving what is called the "full" and "empty" cell treatments; it is adapted to the use of oils or salts or combinations of the two; it enables a variation in the treatment of the same stick, thereby economizing in the absorption of the preservative and concentrating it where it is most needed; and lastly, the absence of high pressure enables the construction of plants which will be relatively low in cost.

The practical development of this process is very recent, and there are a great many problems remaining to be solved. The latter is also true of the various pressure processes, and in order to test all thoroughly and impartially, and to determine the best use to which each is adapted, the Forest Service is erecting a laboratory in Washington that will be the most complete of its kind in existence. This laboratory will have retorts capable of withstanding pressures up to 500 lbs. per sq. in., and will have a complement of force, air and vacuum pumps so that a wide range of methods may be tested. It is the policy of the Forest Service to encourage the preservation of timber just as vigorously as its means will permit, and it will welcome all criticisms and suggestions tending to advance the work, and by so doing aid in its endeavors to conserve our forest resources.

CAST MANGANESE-STEEL RAILS ON CURVES, BOSTON ELEVATED RAILWAY.*

By H. M. STEWARD.†

Within a few months after the elevated division of the Boston Elevated Railway Company was opened for traffic (June, 1901), it was found that the rails on the curves were wearing out at an unprecedented rate. As about 40% of the entire length of the line is curved, the question of maintenance and the cost of rail renewals became, and still is, a serious problem.

The tracks on the elevated division were first laid with Bessemer rail having a low carbon content (about 0.45%) and the life of the outer rail on the sharp curves was very short, averaging about 60 days. On account of this excessive rail wear, the railway company determined to make a trial of manganese-steel rail, and a curve in the subway near Park St. station, having a center radius of 82 ft., was selected for the trial. In 1902 the outer rail of the curve was relaid with manganese rails. These rails were cast in 20-ft. lengths, conforming as nearly as possible to the Am. Soc. C. E. 85-lb. section, and were purchased of William Wharton Jr. & Co., Inc.

The Bessemer rail which was in the track immediately preceding the installation of the manganese rail wore down 0.065 ft. in 44 days, as shown in Fig. 1. The manganese rail remained in service up to August, 1908, when it was removed on account of an accident. It will, however, be replaced in the track within a short time and will be allowed to wear out completely. Fig. 2 shows the result of this experiment after the manganese rail had been in service 6 years, 3 months and 7 days, or 2,291 days. The amount worn from the top of the rail is only 0.046 ft., which is certainly remarkable and illustrates the great resistance this metal offers to rolling friction.

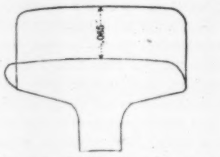

Fig. 1. Ordinary Bessemer Rail. 85 lbs. per yd.; Am. Soc. C. E. section. Laid March 13, 1902. Removed April 26, 1902. Life: 44 Days.

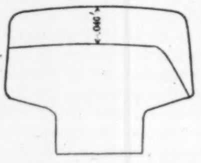

Fig. 2. Cast Manganese-Steel Rail. Laid April 26, 1902. Worn Section traced Aug. 3, 1908 (Rail still in service). Life until Aug. 3, 1908, 2,291 days = 6 yrs. 3 m. 7 d.

Figs. 1 and 2. Original and Final Sections of Ordinary Bessemer and Manganese-Steel Rails, Outer Rail of Curve Near Park St. Station, Boston Elevated Ry.

The traffic over this piece of track in 1902 was, of course, much less than at present, averaging probably 1,000 cars, or 36,000 tons, per day, as against 1,700 cars, or 62,000 tons per day, at present. Consequently the manganese rail, on account of the constant increase in traffic, has given even better service than the comparative results show.

Other instances could be cited, but in these cases the manganese rail has not been in service such a long period of time, although the comparative results are equally as good. This one example, however, is probably sufficient to illustrate the long life and value of rails made from this metal.

From time to time we have made other experiments with special rollings of Bessemer, nickel-steel and open-hearth rails. In 1903 the Cambria Steel Company furnished us with some Bessemer rail having a carbon content of about 0.78%, the wearing qualities of which were very satisfactory when compared with ordinary Bessemer rail and were far better than the nickel-steel and open-hearth rail which we have obtained up to the present time. None of these rails, however, approached the manganese rail in length of life.

As it is of interest to compare the life of different brands of rails under the same conditions, I have selected five curves of short radii and have prepared a tabulation showing the comparative life of five different kinds of rail (see table below). We have not been able to actually test all of these rails on each of the curves, but from the actual results obtained on curves of similar radius we are able to closely estimate the life of the rails.

The general use of manganese steel on tangents does not seem to me to be advisable. Even under the severe traffic of the elevated division ordinary rail has given fairly satisfactory service for over seven years. Our tangent rail does not, of course, receive such hard usage as that on steam roads and the joints do not suffer from the pounding of heavy locomotives. Manganese steel, while offering great resistance to grinding friction, will not, in my opinion, offer as great resistance to heavy blows on account of its ductility. Under heavy locomotive service I should say that the joints would batter and bend down some time before the rail would otherwise wear out. Its high cost also prohibits its use for this purpose.

In our service we find that manganese rail will not withstand side wear equally as well as top wear. The grinding friction from the flat of the tire does not seem to have the same effect on manganese steel as the cutting action of the flanges, and we have found it advisable to protect the side of the head of manganese rail, holding the flanges away from it by means of a check or guard rail fastened securely to the inner rail of the curve. As the guard rail can be readily lubricated, it does not wear out particularly fast and we can afford to allow it take the side wear and in this way protect the manganese rail.

On account of the excellent results obtained from manganese steel, the railway company purchased during the last two or three years about 4,700 lin. ft. of this rail at an average cost of $6.70 per ft.

In 1902 and 1903 the railway company purchased about 700 ft. of manganese rail at an average cost of $5 per lin. ft. The cost of Bessemer rail, to this company, averages about 0.39 cts. per lin. ft.

All the manganese rail used by the company up to the present time has been cast in lengths not exceeding 20 ft. On account of its having been necessary to cast the rail, the cost has been exceedingly high, due not so much to the cost of the metal as to the labor involved in making the patterns, casting, and especially in finishing the rails. As it is not possible to machine the metal, the only way it can be finished to form is by grinding.

Recently the question of rolling manganese rail has been taken up by two companies in this country and at least one in England. It is proposed to roll manganese rails in lengths up to 33 ft. and of any section desired. The Boston Elevated Ry. Co. has not as yet obtained and made a trial of rolled manganese rail, but is about to do so and has already placed orders for a limited quantity. When the rolled manganese rail is received the company proposes to make a comparative test with cast manganese rail of the same quality as was used on the Park St. curve. If the rolling of manganese rail is found to be successful and the metal is as good as when cast, the cost ought to be very much less than at present and the use of the material for track purposes should increase.

We have also used manganese steel extensively in frogs, switch points, etc. The difference in life between manganese steel and ordinary frogs and switch points is great enough to warrant its use and will more than pay for the difference in first cost alone, while if the cost of maintenance is taken into consideration manganese steel is the cheapest metal that can be used.

As to the comparative cost of maintenance, the general maintenance of track, outside of rail renewals, should not vary appreciably whether the track be laid with manganese rail or Bessemer rail.

Taking the curve at Park St. as a basis, and assuming that the life of manganese rail at this point would be eight years and that of Bessemer rail about two months, I should say that the following figures would be a fair estimate of the comparative cost of maintenance per lin. ft. of single rail for a period of eight years:

Cost of manganese rail per foot	$6.70
Bonds, spikes, etc	.09
Labor	.22
Total cost of maintenance	$7.01
Cost of Bessemer rail per foot (50 renewals)	$19.50
Spikes, bonds, etc	3.25
Renewals of ties, account "spike killing"	2.90
Labor	15.50
Total	$41.15

This comparison, you will understand, is made from one specific case in which the costs can be very closely estimated. The same proportions might or might not apply in other instances.

*A paper presented before the American Street and Interurban Railway Engineering Association at Atlantic City, N. J., Oct. 16, 1908.

†Roadmaster, Boston Elevated Ry. Co., Boston, Mass.

COMPARATIVE LIFE OF RAILS ON TYPICAL SHARP CURVES, BOSTON ELEVATED RY.
Speed of trains from 8 to 10 miles per hour.

Location of Curve.	Radius.	Ordinary Bessemer Rail.		High Carbon Bessemer Rail.		Nickel Steel Rail.		Manganese Steel Rail.		Open-Hearth Rail.	
		Mos.	Days	Mos.	Days	Mos.	Days	Mos.	Days	Mos.	Days
Park St. (Subway), southbound track	82 ft.	2	3	8	18†	3	12†	76	4*	1	11
Adams Sq. (Subway), northbound track	89 "	2	17	10	15	4	4†	80	10†	1	27
Park St. (Subway), southbound track	90 "	2	16	10	11†	4	3†	66	15*	1	20†
Haverhill St., northbound track	100 "	4	3	11	13	6	19	128	9†	2	21
Sullivan Sq. Loop	106 "	3	7	13	8	5	7†	101	5†	2	7

*Still in service. †Estimated life from actual results on curves of similar radius.

A REMARKABLE SEWAGE-DISPOSAL PROBLEM AT BELFAST, IRELAND.

The growth of enormous quantities of green seaweeds in the bay adjacent to the city of Belfast, Ireland, has given rise to a series of interesting reports on these growths and on the general subject of improved means of sewage disposal for Belfast. We are indebted to Dr. E. A. Letts, Professor of Chemistry and Joint Lecturer on Sanitary Science in Queen's College, Belfast, for a copy of his final report on the subject (dated May, 1908.) The report is over a hundred pages in length and is accompanied by a number of folding plates. It includes studies designed to show the character and extent of the pollution of Belfast Lough, as the bay is called, and also a summary of various experiments on the treatment of Belfast sewage with a view to producing an effluent that would not give rise to the growth in question, which is chiefly *Ulva latissima.*

It appears that this growth is greatly accelerated by both free ammonia and nitrates. The problem of sewage treatment to prevent the growth is complicated by the fact that in ordinary methods of treatment the reduction of the free ammonia is accompanied by a production of nitrates. The proposed solution of the problem is virtually a combination of a nitrification and denitrification process.

In opening his report, Dr. Letts states that the Belfast problem is

> an entirely new one in the history of sewage-purification methods, and is exactly the reverse of that which the earlier workers on these methods endeavored to solve, namely, the utilization of the constituents of sewage for the cultivation of crops.

He adds that subsequent to his investigation he has found that *Ulva latissima* grows in abundance in other places where sea-water is polluted by sewage, notably at Teignmouth, Falmouth, Southampton and Chichester. Nuisances due to the same cause have also been reported from Barmouth, Cromer, Margate, Penzance and elsewhere. He has heard of no instance of *Ulva* occurring in quantity in unpolluted water.

Dr. Letts experimented with double contact beds alone, septic tank and double contact beds, a septic tank and sprinkling filter, and finally a septic tank, sprinkling filter and denitrifying filter. The report does not make quite clear just what the character of the denitrifying filter was, but there seems reason to think that it was or resembled a contact bed.

He states that the denitrifying beds will not add materially to the cost of a sewage-treatment plant, since under ordinary weather conditions the storm filter beds (which he assumes will be necessary) can be used for denitrification. This, he says, will keep the storm filter beds "in an efficient condition for the purification of the dilute sewage passing through them during periods of storm." Moreover, sprinkling filters will be required under this plan for the treatment of only a portion of the sewage.

The conclusions and recommendations of Dr. Letts' report, in so far as they relate to the character of sewage works proposed, may be quoted as follows:

> After screening, and the removal of road detritus, the sewage should be submitted to a process of sedimentation in suitable tanks for a period of six hours, then a portion thus clarified should be treated on sprinkling filters, after which the resulting effluent should be mixed with the remainder of the tank effluent, and the mixture submitted to further treatment on a denitrifying bed, then discharged into ponds or lagoons, and thence into the Lough. Provisionally, a mixture of equal volumes of the tank and sprinkler effluents may be treated on the denitrifying beds, and the working cycle of the latter may be four hours contact and two hours rest; but it is quite possible that future experience may show that these conditions may be so modified as to induce a more complete purification than that hitherto obtained, which amounts to about 80% in those factors which affect the growth of the *Ulva.*
>
> The process of purification proposed thus involves three principal and consecutive operations, the effects of which may be summarized as follows:
>
> (1) Removal of road detritus (by catch-pits), gross solids (by screening), and the greater portion of the suspended solids (by sedimentation). These solids have hitherto affected the Lough in two ways—(a) by causing deposits which have to be dredged, and (b) by slowly evolving ammonia which has encouraged the growth of the *Ulva.*
>
> It is probable that from ⅔ to ¾ of the total of the above-mentioned solids will be got rid of by the process named, and that the effect in relation to the ammonia will be a purification of about 17 to 20%.
>
> (2) Treatment of the sedimented sewage by sprinkling filters followed by a short period of sedimentation to remove the solids breaking away from the filters and which subside rapidly. This, so far as the Belfast problem is concerned, involves (a) the removal of the remainder of the suspended solids, (b) the removal of free ammonia, (c) the production of nitrates.
>
> It is somewhat difficult to give a definite statement as to the degree of purification to be expected from this method of treatment, but the mean of all the different experiments made shows a total of about 70%.
>
> (3) Treatment by denitrification. This will probably induce a further purification of 10 to 12%, or a total of 80 to 82%.

THE PREMATURE EXPLOSION of a blast in the Ingleside lime quarry, 18 miles from Fort Collins, Colo., Oct. 15, killed seven men and injured 23 others.

A TYPHOID FEVER EPIDEMIC at West Pullman, Ill., appears to be traceable to milk supplied by a dairyman in whose family three cases of typhoid occurred.

THE EXPLOSION OF A BOILER at West Seneca, N. Y., Oct. 13, killed one man and injured two others. The boiler was being used by a sewer construction company to supply steam for a pump.

A FIRE IN CHICAGO, Oct. 16, consumed the docks of the International Salt Co. on the Calumet River at 103d St. and destroyed the offices of the Elgin, Joliet & Eastern Ry. and 50 freight cars. The fire started in the salt company's cooperage shop. It is reported that 650,000 bbls. of salt were destroyed. The loss is estimated at $1,000,000.

THE TIMBERS OF A SEWER TUNNEL GAVE WAY at Portland, Ore., Oct. 6, and two men were killed in the cave-in which followed. The accident occurred 300 ft. from the mouth of the tunnel in the Brooklyn sewer between East Sixth and East Seventh Sts.

FOREST FIRES have again broken out in New York, Connecticut, Massachusetts, Vermont, West Virginia, Pennsylvania, Indiana, Ohio, Wisconsin and Michigan. The fires in the northern portion of Michigan's Lower Peninsula have been the most destructive, having spread over the counties of Presque Isle, Alpena, Montmorency, Cheboygan and Otsego. Less destructive fires are reported in other adjacent counties, and in the eastern end of the Lower Peninsula. Two villages, Metz in Presque Isle Co. and Koss in Menominee Co. have been partially burned. A relief train on the Detroit & Mackinac Ry., loaded with refugees from Metz, was derailed while attempting to run through a stretch of burning forest. The passengers found themselves between burning piles of ties on one side and burning cars of bark and lumber on the other. Eighteen were burned to death and many others are missing. The total number known to have died as a result of the fires in Michigan is given as 41. More than 500,000 ft. of cut timber have been burned in Otsego Co.

In New York the fires in the Adirondack region have destroyed large areas of standing timber and several villages and hamlets have had narrow escapes. The condition in Pennsylvania is equally bad. Forest fires are said to be burning in 20 counties in Indiana. In Wisconsin the country for six miles east of Namekagon Lake is described as a mass of burning timber. Lesser fires are reported in the vicinity of Williams, W. Va.; Lisbon, Ohio; Winchester, Conn.; the Berkshire Mts. in Massachusetts and the foothills of the Green Mountains in southern Vermont.

RAILWAY ACCIDENTS during the week have been reported as follows: A burning bridge on the Missouri Pacific Ry., two miles east of Shannon, Kan., gave way under a westbound passenger train Oct. 14. The bed of the stream spanned by the bridge was dry. The approach to the bridge is at the end of a sharp curve so that the engineer did not discover the fire in time to stop his train. The rear coaches went down with the collapse of the bridge and were burned, but the occupants escaped.

A hot box caused the derailment of a car in a freight train on the Lake Shore & Michigan Southern Ry. at Amherst, O., Oct. 14. The cars immediately following were wrecked and the hot box set fire to the wreckage. A tank car loaded with gasoline exploded, severely burning six firemen and spectators.

A head-on collision between a passenger train and an extra stock train on the Atchison, Topeka & Santa Fe Ry., 13 miles east of Newton, Kan., took place Oct. 18. Twenty-two passengers were injured, and the engineer of the stock train and 40 head of cattle were killed.

A passenger train on the Chicago, Rock Island & Pacific Ry. collided with an extra freight at a siding midway between Ramah and Mattison, Col., Oct. 18. Three men were seriously injured.

The boiler of an eastbound freight locomotive on the Southern Ry. exploded at Mayo, Va., Oct. 13, killing the engineer and injuring two firemen. The train, which was drawn by two locomotives had stopped to take water, and the engineer was engaged in oiling the engine when the explosion occurred. His fireman, who was presumably in the cab, was hurt about the head and claims to remember nothing about the accident.

THE COLLAPSE OF A BRIDGE PIER is reported from Oxbow, Sask., but without particulars. The pier was part of a concrete structure being built for the Canadian Pacific Ry.

A MONORAIL STREET-RAILWAY will probably be built in New York City. The Interborough Rapid Transit Co., which, besides operating the subway and owning and operating the elevated railways, owns several short stretches of surface railway in outlying parts of the city, has sold the Pelham Park & City Island R. R. Co., a short horse-car line in the extreme northeastern part of Bronx Borough, to the Monoroad Construction Co. The latter concern has now made application to the Public Service Commission to construct a monorail road on this line. H. B. Reed is Chief Engineer of the company, and H. H. Tunis is Consulting Engineer.

A RAILWAY FROM LARISSA TO ATHENS and thence to the Piraeus was opened for traffic a month ago. An extension from Larissa (in northern Greece) to the Turkish frontier is now under construction and will be completed shortly. About 50 miles will then be lacking to give connection with the railway system of Turkey and via the Turkish lines with central Europe.

THE LONG WATER RATE WAR between the city and county of San Francisco and the Spring Valley Water Co. has taken on a new phase through an interlocutory injunction against the enforcement of the 1908-9 rates recently fixed by the county supervisors. The water rates have been at issue since an action brought by the company in 1903. Since then the company has been collecting the rates of 1902, although the rates are supposed to be fixed by the supervisors yearly. The year 1905 was largely occupied in taking testimony, which, perhaps partly owing to the earthquake of 1906, has never been submitted to the court. The present decision upholds the right of the city (or county) to fix "just and reasonable rates." The value of the water-works, for rate-making purposes, is set at $27,550,000 and on that amount it is held that the company is entitled to earn 5% interest, above taxes, operating expenses and depreciation. Earthquake damages are excluded from depreciation allowances, the latter being set at $160,000. Pending a final decision on the points at issue, the company may charge a rate 15% in excess of the recent ordinance rate, but all moneys collected in excess of the ordinance rate must be paid into court and there held until final decision is reached. The company was given ten days to accept the restraining order, failing which the prayer for the injunction would be denied.

AN INJUNCTION AGAINST THE PASSAIC VALLEY trunk sewer has been applied for in the name of the Attorney-General of New York State. The U. S. Supreme Court has set Jan. 4, 1909, as the date for answering the application. The application alleges that the proposed discharge of the sewage of Newark, Paterson and other municipalities into New York Bay would be a menace to health and a damage to the harbor, and that under a compact of 1833, New Jersey granted New York police jurisdiction over the waters adjacent to the New Jersey shore.

The effect of the action just outlined is to prevent the Passaic Valley District Sewerage Commission from proceeding with the trunk sewer project, possibly for several years to come. It is now nearly fifteen years since the agitation for cleaning up the Passaic River began. A number of years were occupied in more or less superficial investigations by temporary committees. Then a permanent district commission was appointed. Just as the commission was about to sell bonds for a trunk sewer the statute under which it was acting was declared unconstitutional. The remedial legislation secured made it optional whether or not the several municipalities within the district should enter the scheme. Most of the municipalities have decided to do this. The latest decision of moment has just been made by the city of Paterson, which heretofore has done much to oppose and postpone the sewer. Paterson's acceptance of the scheme, however, was conditional on the final estimates coming within the preliminary estimate of some $12,000,000 for the trunk sewer and accessories. The acceptance was also made with the idea that probably it would precipitate the injunction application already outlined.

A LARGE BRIDGE IS BEING BUILT over the Vistula River at Marienwerder, Germany, to furnish a double-track crossing for a new railway line between Schmentau and Riesenburg. The river at the crossing is about 5,000 ft. wide between levees, but to shorten the bridge one of the levees was shifted, thereby reducing the length to 3,475 ft.; less than half this space is occupied by the normal channel. The river has a flat cross-section, in rather soft bottom. This fact, and the necessity of safeguarding against scour required the pier foundations to go down from 30 to 50 ft. below water surface. Long spans were dictated by these conditions, but more strongly by the ice conditions in winter, which are such that the navigation authorities were led to demand minimum obstruction of the total channel width by piers. In response to this the bridge was designed with ten spans, of which five are parallel-chord truss spans each 256 ft. long c. to c. end pins (two at left bank, three at right bank), and five are curved top chord truss spans each 426½ ft. long c. to c. end pins. The clear width of the roadway is 37 ft., of which about 11 ft. is available as a highway crossing, while the rest of the width accommodates the two railway tracks. The trusses have a simple triangular web-system with intermediate vertical stays to subdivide the panel lengths and a further subdivision by a bottom subvertical system. The main panels are 64 ft. in the shorter spans and 86½ ft. in the long spans, making the subpanels 16 ft. and 21½ ft. long, respectively. The connections are of course all riveted. The total weight of the ten spans is about 13,000 tons. The construction of the bridge was begun in 1905. Pneumatic caissons were sunk for the nine piers, while the abutments were founded behind cofferdams. The piers are at present all completed, and six spans of the superstructure have been erected. The spans are erected on pile trestle falsework having 40-ft. spans for navigation and logging. The bridge will probably be completed within a year. The total cost will be over two million dollars. The piers were built by P. Holzmann & Co., of Frankfurt a. M., and the superstructure is being built by a syndicate of three companies, the Harkort Co., of Duisburg, the Gutehoffnungshütte of Oberhausen, and the Vereinigte Königs & Laurahütte Co. of Königshütte. The work is under the direction of the Prussian Railways.

MUNICIPAL CONTROL OF PUBLIC UTILITIES IN GERMANY.—There are now 58 cities in the Empire containing over 50,000 inhabitants. In these cities the leading utilities are owned and conducted by the municipalities to the following extent:

Public utilities.	Number of cities.
Gas works	44
Electric power plant	38
Water-works	43
Abattoirs	47
Bath houses	42
Street railroads	10
Removal of garbage and sewage	56
Market halls	16
Tenement houses (chiefly for municipal employees and laborers)	22

In regard to financial results the gas works make the best showing. Their total profits amount annually to $10,100,000. Of this sum about $2,500,000 is required for interest on the investment. Electrical works show a profit of $4,200,000, of which $1,300,000 is expended for interest. Water-works return on an average of 8.5% of the capital invested. Market halls and tenements yield bu little profit. The entire capital invested by German municipalities in plants for public utilities is now estimated at nearly $1,000,000,000. The value of forests and meadows, as well as the capital of municipal banks and loaning organizations, is not included in this total.

While so much activity in this field is developed by the German cities, there is but little evidence of a tendency to invade indiscriminately the economic territory of general industrial competition. Municipal control is established when there is simply the choice between a public and a private monopoly, as in the case of gas, water, electricity, etc., or else when the desirability of a utility is unquestioned, but the uncertainty as to profitable returns fails to attract private capital. There is but little probability that German municipal enterprise will step outside these limitations. The telegraph and telephone in Germany are owned and managed by the Imperial Government, and most of the railway lines are the property of the different states.—From the report of Consul T. H. Norton, of Chemnitz, in the October Consular and Trade Reports.

PERSONALS.

Mr. T. S. Leake, Supervisor of Buildings of the Missouri Pacific Ry., has resigned to engage in general contracting in Chicago.

Mr. T. F. Barton has been appointed Master Mechanic of the Delaware, Lackawanna & Western R. R., at Kingsland, N. J., succeeding Mr. A. C. Adams, resigned.

Mr. G. L. Wetmore, Division Engineer of the Lake Superior Division of the Canadian Pacific Ry., has been transferred to the Atlantic Division, with headquarters at St. John, N. B. Mr. Frank Taylor, Assistant Engineer at Montreal, will succeed Mr. Wetmore as Division Engineer at North Bay, Ont.

Mr. James McNaughton, M. Am. Soc. M. E., has succeeded Mr. R. J. Gross, resigned, as Vice-President of the American Locomotive Co. and Manager of the Sales Department. Mr. Wm. L. Reid, M. Am. Soc. M. E., will succeed Mr. McNaughton as Manager at the Schenectady works.

Mr. B. A. Behrend, M. Am. Inst. El. E., Chief Engineer for five years of the Electrical Department of the Allis-Chalmers Co., has severed his connection with the Allis-Chalmers interests. Mr. David Hall, Assoc. Am. Inst. E. E., Assistant Chief Engineer of the Electrical Department, and Mr. Allan B. Field, Assoc. Am. Inst. E. E., in charge of alternating current work of the same company, have also left their positions.

The following appointments at the College of Applied Science of the State University of Iowa are announced: Mr. Sherman M. Woodward, M. Am. Soc. M. E., Irrigation Engineer, U. S. Department of Agriculture, has become Professor of Hydraulics and Engineering Materials, and acting head of the Department of Mechanical Engineering. Mr. Woodward holds degrees from Washington University and Harvard.

Mr. Arthur W. Hixson has been appointed Instructor in Mining and Metallurgy in charge of the Department of Mining. Mr. Hixson graduated at the University of Kansas in 1907.

Mr. John E. Boynton, who graduated at the University of Wisconsin in 1905, has been appointed Instructor in Steam Engineering.

Obituary.

William Trethway, Underground Superintendent of the Amygdaloid branch of the Calumet & Hecla mine at Calumet, Mich., was struck by a skip and instantly killed Oct. 15.

James Daly, who was for many years connected as a civilian with the Corps of Engineers of the U. S. Army, died at his home in Washington, D. C., Oct. 12, at the age of 80 years.

Bennett H. Brough, Secretary of the Iron & Steel Institute, died at Newcastle-on-Tyne, England, Oct. 3. Mr. Brough was the author of a "Treatise on Mine Surveying" and of numerous papers on mining and metallurgy. He was formerly Instructor in Mine Surveying at the Royal School of Mines.

Frederic A. C. Perrine, M. Am. Inst. E. E., died of Bright's disease, Oct. 20, at his home in Plainfield, N. J. Mr. Perrine was born in Manalapan, N. J., in 1862. He graduated at Princeton in 1883 with the degree of A. B., took up post-graduate work during the two following years, specializing in electrical engineering, and in 1885 received the degree of D. Sc. He then became Assistant Electrician of the United States Electric Light Co., and remained with them until, in 1889, he entered the employ of the John A. Roebling's Sons Co. as Manager of the insulated wire department. Leaving this company in 1892, he became Treasurer of the Germania Electric Co. In June, 1893, he married Miss Margaret J. Roebling and, in the same year, was appointed Professor of Electrical Engineering at Leland Stanford, Jr., University, where he remained until 1900. During his last two years at Stanford, Mr. Perrine acted as Chief Engineer of the Standard Electric Co., of California, which was at that time engaged in the construction of long, high potential transmission lines taking power into San Francisco from hydro-electric plants in the mountains. He returned to the East in 1900 as President of the Stanley Electric Mfg. Co., of Pittsfield, Mass., and occupied this position for four years. Since 1904 he has maintained an office as a consulting engineer. Mr. Perrine has contributed several articles on topics of interest to mechanical and electrical engineers to the technical journals and to society proceedings. He was an editor of the "Journal of Electricity," published in San Francisco, from 1894-6, and "Electrical Engineering" in the two following years. He is survived by his wife, two daughters and a son.

William Hankins, Principal Locating Engineer for the Carolina, Clinchfield & Ohio Ry., died Sunday noon, Aug. 23. The final cause of his death was heart failure, but he had never fully recovered from the effects of an acute attack of grippe which he suffered last winter. Mr. Hankins was the son of George J. Hankins, of Bacon's Castle, Surrey Co., Va. He was born in 1849, was at one time a student at William and Mary College, Williamsburg, Va., and graduated with honor in civil engineering at the Virginia Military Institute in 1873. In the same year he secured a position as Assistant to the Resident Engineer in the construction of the Chesapeake & Ohio Ry. in West Virginia. During the remaining 35 years of his life, Mr. Hankins was connected—in most cases as engineer in charge of location work—with 22 different railways, mainly in the southern and southwestern states. From 1879-80 he was Assistant Engineer on the location of the Denver & Rio Grande R. R. in Colorado and New Mexico; from 18[illegible] Engineer in Charge of Surveys and Location of the [illegible]essee Midland Ry. (now part of the main line of [illegible] Louisville & Nashville Ry.); 1890-92, Engineer in [illegible] of Location and Division Engineer in charge of [illegible]uction of the Georgia, Carolina & Northern Ry. ([illegible] part of the Seaboard Air Line Ry.); in 1899-190[illegible] Chief Engineer of the Greenbrier Ry., a 100-mi. bra[illegible] the Chesapeake & Ohio Ry. His last position, [illegible] he had held since June, 1905, was that of Princip[illegible]ocating Engineer of the South & Western Ry. and [illegible]ion Engineer of the Blue Ridge Division. This [illegible] has recently become the Carolina, Clinchfield & Ohi[illegible]

The ability of Mr. Hankins as a lo[illegible] engineer is well exemplified by his work in plan[illegible] the line for the loop construction of this railway d[illegible] the southern slopes of the Blue Ridge Mountains, an[illegible] the location of the line south of and supplementin[illegible] Blue Ridge development. He is survived by hi[illegible]fe, formerly Miss Marcella Barrett, of Goochland Co[illegible], two sons and a daughter.

ENGINEERING SOCIETIES.

COMING MEETINGS.

AMERICAN ELECTROCHEMICAL SOCIETY.
Oct. 30-31. Fall meeting at New York City. Secy., Dr. J. W. Richards, Bethlehem, Pa.

ROADMASTERS AND MAINTENANCE-OF-WAY ASSOCIATION OF AMERICA.
Nov. 10-12. Annual meeting at Milwaukee, Wis. Secy., W. E. Emery, West Chicago, Ill.

AMERICAN RAILWAY ASSOCIATION.
Nov. 18. Annual meeting at Chicago, Ill. Secy., W. F. Allen, 24 Park Pl., New York City.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS.
Nov. 19-20. Annual meeting at New York City. Secy., W. J. Baxter, 29 West 39th St., New York City.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS.
Nov. 30-Dec. 1. Annual meeting at New York City. Secy., W. H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.
Dec. 1-4. Annual meeting at New York City. Secy., Calvin W. Rice, 29 West 39th St., New York City.

AMERICAN INSTITUTE OF ARCHITECTS.
Dec. 15-17. Annual convention at Washington, D. C. Secy., Glenn Brown, "The Octagon," Washington, D. C.

WESTERN RAILWAY CLUB.—At the meeting held in the Auditorium Hotel, Chicago, Oct. 20, Mr. E. W. McKenna, Second Vice-President of the Chicago, Milwaukee & St. Paul Ry. Co., gave an address on the subject, "A Constituency Without Representation."

CANADIAN SOCIETY OF CIVIL ENGINEERS.—A meeting of the Electrical Section is to be held in Montreal, Oct. 22. A paper on "Straight Air Brake Equipment," by Mr. J. B. Parkham, will be read. There will be a meeting of the Mechanical Section at Montreal, Oct. 29.

RAILWAY SIGNAL ASSOCIATION.—At the closing session of the annual meeting at Washington, D. C., Oct. 15, officers were elected as follows: President, L. R. Clausen, Division Superintendent, Chicago, Milwaukee & St. Paul Ry., at Chicago; First Vice-President, H. S. Balliett, Signal Engineer, Electrical Division, New York Central & Hudson River R. R.; Second Vice-President, C. E. Denney, Signal Engineer, Lake Shore & Michigan Southern Ry.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION.—The second annual convention will be held at Atlanta, Ga., Nov. 19-21. The meetings of this convention will be held at the State Capitol, House of Representatives, and there will be arranged in the corridors of the Capitol an exhibition of the work of trade school pupils. Among the addresses to be given are the following: "Industrial Training Through the Apprenticeship System," E. P. Bullard, Bridgeport, Conn.; "Promotion of Industrial Education by Means of Trade Schools," George N. Carman, Chicago, and John M. Shrigley, Williamson, Pa.; "Industrial Education in the Public Schools," Thomas M. Balliet, New York City, and L. D. Harvey, Menomonie, Wis.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The November meeting will be held in the Engineering Societies' Building, 29 West 39th St., New York City, on Tuesday evening, Nov. 10. Mr. Franklin Phillips, President of the Hewes & Phillips Iron Works, Newark, N. J., will make an address on "The High Powered Rifle and Its Ammunition—Instruments of Precision," illustrated by lantern slides. Mr. Phillips is an expert marksman, and is now Ordnance Officer of the Second Infantry of New Jersey. He has participated in tests of rifles and ammunition at Sea Girt, N. J., by men connected with the N. J. National Guard, which have led to marked improvement in arms and ammunition and to an entire change in the powder used by the government, thereby greatly increasing the accuracy of the shot. The improvement has been extended to large guns and instead of 2% hits which were made at Santiago, 80% is now the average in some ships.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. New York, October 22, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(denotes that this work is advertised in Engineering News.)*

The following Plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

Bids close.	Work. Place.	See issue.
10-24	Dumb waiters, Washington, D. C. .... (S.)	10-22
10-24*	Power plant, University, Ala. (S.)	10-22
10-26	Sewer, Wilkes-Barre, Pa. (P.& S.)	10-15
10-26*	Viaduct work, Lynchburg, Va. ....(P. & S.)	10-22
10-28*	Sewers, Rye, N. Y.....(P. & S.)	9-24
10-30	Pipe, Passaic, N. J..........(S.)	10-17
10-30*	Dredging, Tuckerton, N. J...(S.)	10- 8
11-14	Coal-handling plant, Charleston, S. C. ....(S.)	10-15
11-16*	Sewers, Hartwell, Ohio.......(S.)	10-22
11-17*	Lock and dam, Mobile, Ala. .. ..(P. & S.)	9-17
11-21	Alterations of bldgs., Philadelphia, Pa. ....(S.)	10-22
11-30	Aqueduct, Los Angeles, Cal..(S.)	10-22
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10-23 Franchise, Leesburg, Fla.........10-22
10-24 Lighting, Richwood, Ohio 10-22
10-24*Power-plant, University, Ala......10-15
10-26 Elec. equip., New York........10-15
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10-24 Bridge, Sabina, Ohio 10-15
10-24 Bridge, Las Animas, Colo.......10-22
10-25 Bridge, San Bernardino, Cal.....10-22
10-26*Viaduct work, Lynchburg, Va.....10-15
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10-27 Bridge, Portsmouth, Ohio.......10- 8
11- 2 Culvert, Lincoln, Neb............10-22
11- 2 Abutment, Philo, Ohio 10-22
11- 5*Bridge, Austin, Tex.............10-15
11- 7 Bridges, Frankfort, Ind..........10- 8
11-11 Bridge, etc., Cleveland, Ohio.....10-22
11-11 Bridge, Toledo, Ohio 10-22
11-12 Bridge, Charles City, Iowa........10-15
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10-23 Alterations, New York.............10-15
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10-24 Dumb waiters, Washington, D. C.10-22
10-24 Laboratory, etc., University, Ala.10-22
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10-26 Forced draft system, Elmira, N. Y. 10-22
10-26 Furniture, etc., for schools, New York, N. Y. ....,
10-26 Lodging house, New York.......10-22
10-26 Ice-making plant, Leavenworth, Kan ....(Mfg. Pl.)10-22
10-27 Comfort station, New York.......10-22
10-27 Drill hall, Quebec, Que...........10-22
10-27 School, Paterson, N. J...........10-15
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10-30 Storehouse, Honolulu, H. T. (U. S. Poss.) 10-15
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11- 1 Factory, Anderson, Ind. (Mfg. Pl.)10-15
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11-17*Hospital, Weehawken, N. J........10-15
11-18*Post-office, New Ulm, Minn........10-15
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10-26 Sewers, Council Bluffs, Iowa 10-22
10-26 Sewer laterals, Beloit, Wis. 10-22
10-26 Sewers, Omaha, Neb. 10-22
10-26 Sewer, Hartford, Conn. 10-22
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10-27 Sewers, etc., New York 10-15
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10-23 Street impvt., Columbus, Ohio....10-22
10-23 Road impvt., Cincinnati, Ohio...10- 8
10-24 Road, Grand Rapids, Minn........10-22
10-24 Grading, etc., Florence, Ala.....10-22
10-24 Road, Portland, Ind...............10- 1
10-24 Macadam, Lexington, Ky..........10-15
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10-27 Regulating, etc., New York, N. Y.10-15
10-28 Grading, etc., Ottawa, Kan.........10-15
10-28 Regulating, etc., Brooklyn, N. Y.10-15
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11- 2 Road, Hartford City, Ind. 10-22
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11- 4 Regulating, etc., Brooklyn, N. Y..10-22
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11- 4 Roads, Corydon, Ind. 10-22
11- 4 Road, Monticello, Ind. 10-22
11- 5 Road gravel, etc., New York.....10-22
11- 6 Road, Indianapolis, Ind. 10-22
11- 6 Roads, Lafayette, Ind. 10-22
11- 7 Road, Kansas City, Kan............10-15
11- 7 Road, Crawfordsville, Ind.........10-15
11- 9*Roads, Albany, N. Y...............10-15
11- 9 Sidewalks, Ashland, Ohio 10-22
11-11*Roads, Albany, N. Y...............10-15
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10-27 Breakwater, Rondeau, Ont. 10-22
10-28 Locomotives, Panama 10-15
10-28 Fire engines, etc., Baltimore, Md.10-22
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10-30*Dredging, Tuckerton, N. J.......10- 8
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11- 3 Levee, Vicksburg, Miss. 10-22
11- 3 Remov'g wreck, Wilmington, Del.10-22
11- 3 Breakwater and dredging, Port Burwell, Ont.......................10- 8
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11-17*Barge canal, Albany, N. Y. 10-22
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11-18*Coal tower, San Francisco, Cal..10- 8
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11- 2 Electric plant, Chile............ 7-16
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11- 4 Reservoir, India 8- 6
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RAILWAYS.

ALBERTA CENTRAL.—The Dominion Government has granted this company a subsidy of $200,000 to build from Red Deer, Alta., to the Rocky Mountains, a distance of 70 miles. The head office of the company is at Red Deer. Reports state that construction will be started this fall.

ATLANTIC NORTHERN & SOUTHERN.—It is announced that this company has under consideration plans for building an extension north from Kimballton, Iowa. A committee, consisting of J. E. Bruce, Drace Lorenson and J. H. Simmons, was appointed last spring to secure bids on the work of promotion, selling stock, furnishing preliminary surveys and other steps toward the extension of the road north to Manning and south to Villisca, as noted on May 7. James H. Jones is Gen. Mgr.; C. B. Judd is Ch. Engr., Atlantic, Iowa.

BONLEE & WESTERN.—Charter has been granted to this company in North Carolina. It will construct a railroad through Chatham and Randolph Counties, 14 miles from Causey, Chatham County, to a point on Deep River, in Randolph County. The capital is $150,000. The incorporators are J. H. Dunlap, Charles Burnes, C. M. Andrews, W. T. Brooks, J. H. Kennedy and C. C. Burns of Raleigh, N. C.

CANADIAN NORTHERN. — Preliminary surveys have been made, it is stated, for a 50-mile extension from this company's coal fields, which extend over 20,000 acres near the Brazeau River, Alta., to connect with the line of the Grand Trunk Pacific at a point between the Pembina and McLeod Rivers.

CAIRO & ST. LOUIS.—Incorporated in Illinois, with $100,000 capital stock, to build from a point in or near Cairo, Ill., north to a point in or near East St. Louis. The incorporators and first board of directors are: William B. McKinley, George M. Mattis, W. H. Carnahan and George W. Burton, all of Champaign, Ill., and L. E. Fischer, of Danville, Ill.

CAROLINA, CLINCHFIELD & OHIO.—Bids were received by MacArthur Bros. Co., Spartanburg, S. C., on Oct. 3, for 31 miles of railroad work on this railroad between Spartanburg, S. C., and Bostic, N. C., as follows: approximately 2,000,000 cu. yds. steam shovel and team work; 35,000 cu. yds. concrete masonry; pile and trestle bridges, etc. This project was noted fully on March 19. We are officially advised that the MacArthur Bros. Co. has sublet practically all the work to the following firms: J. NUCKOL, of Parkersburg, W. Va.; PURCELL, ALLEN, SHEEHAN CO., of Washington, D. C.; WILLIAMS, LEWIS & SPRADLIN, of Macon, Ga.; LEONARD, BECKMAN & CO., Parkersburg, W. Va.; YALE & REAGAN, Fisher Bldg., Chicago, Ill.; R. L. McCURRY & CO., Marion, N. C.; A. G. FRETWELL, of Anderson, S. C.; MASON BROS., Bridgeport, Ala.; M. M. SCHLITZ, of Knoxville, Tenn.; ASHVILLE CONSTRUCTION CO., of Ashville, N. C.; THOS. SHEEHAN, of Batavia, Ill., and J. C. DUNN, Century Bldg., Cleveland, Ohio. It is expected that work will be completed in about seven months. Work is mostly steam shovel with some team work in connection. John Reid is Division Engr. for South & Western R. R.; M. J. Caples is Ch. Engr., Johnson City, Tenn.

CHICAGO & ALTON.—It is planned to rearrange local yards at Jacksonville, Ill., and to extend and reconstruct the terminal freight yards at Chicago.

COLORADO & SOUTHERN.—New lines under consideration, as announced, include an extension from Orin Junction, Wyo., to Forsythe, Mont., 260 miles; Fort Collins, Colo., to Cheyenne, Wyo., 40 miles; double track, Pueblo to Walsenberg, Colo., 56 miles. H. W. Cowan is Ch. Engr., Denver, Colo.

DAKOTA & WESTERN.—Incorporated in South Dakota, with $100,000 capital, to build from Rapid City, S. Dak., southwest to Hill City, 20 miles, with a provision for an extension westerly into Wyoming. The incorporators are: A. M. Lanphere, W. H. Lanphere, T. A. Mair, Knute Kleven and J. W. Cook, all of Rapid City.

DENVER & RIO GRANDE.—An expenditure of from $10,000,000 to $12,000,000 is about to be made by the Denver & Rio Grande Ry. for enlarging its terminals in Denver, Pueblo, Grand Junction, Salida, and Salt Lake, and for the purchase of additional equipment, according to the New York "Times." "The company is making final plans to take care of the business which will result from the completion of the Western Pacific Ry. to San Francisco. Detailed plans of the company will be made public in a short time. They include the spending of about $5,000,000 in Denver alone. The Gould companies will make Denver the gateway to the Pacific. The principal Western yards of the company will be in this city. It is probable that the Missouri Pacific will extend its central branch from Lenora, Kan., to Denver, and the Goulds will have a short line to the Pacific through this city. More than $4,000,000 will be expended for cars and engines. Recently the company received $1,000,000 worth of steel freight cars, and 28 locomotives. The new order will be placed within a short while. Land for the expansion of terminals will be secured in Denver, and other heavy expenditures will have to be made."

ESTACADO & GULF.—W. A. Butts, Pres., Roby, Tex., states that this railway will build from McCaulley, Tex., to Grider, ten miles. We were recently officially advised by Mr. Butts that grading has been finished from Roby to McCaulley, Tex., (on the Kansas City, Mexico & Orient Ry.), 14 miles; grading is in progress east of McCaulley. The railway will run from Roby to Coleman, Tex., 100 miles. Right-of-way and capital are secured. Surveys are partly made. T. H. Landon is Ch. Engr., Roby. Noted on June 18.

GEORGIA & FLORIDA.—The Georgia & Florida Railroad Co., which is constructing a trunk line between Augusta, Ga., and Madison, Fla., has been granted a two-year extension of time for complying fully with the law in regard to charters by the Secretary of State. The law requires that a newly chartered road must have at least 15 miles in operation within two years or forfeit the charter unless an extension is made. While this company has purchased 217 miles of road already built, and has constructed a large amount of new road, it has not in operation a single part of the latter extending 15 miles. The line between Nashville and Valdosta, has been graded, a distance of 30 miles, and rails are being laid. Work has been started between Hazlehurst and Vidalia, and the company expects to have a direct line of road in operation between Millen, Ga., and Madison, Fla., within the next 12 months, with a branch line from a point near Summit, Ga., to St. Clair, Ga., ready for operation at about the same time. J. M. Turner is Gen. Mgr., Douglas, Ga.

INTERNATIONAL OF NEW BRUNSWICK.—The Dominion Government has granted a subsidy contract to this company for building a line from Campbellton, N. B., to St. Leonards, on the St. John River, about 90 miles. T. MALCOLM, of Campbellton, N. B., has the contract.

MATANE & GASPE.—In a recent item regarding proposed construction of this railway the name of the general contractor was given as the H. J. Burmer Co. It should be H. J. BEEMER CO., 42 Broadway, New York.

MICHIGAN.—The Common Council of Owosso, Mich., has granted to the New Haven Coal Mining Co. a franchise to enter the city with a steam railroad from the company's mines, six miles north. The taxpayers will vote on election day on the proposition to give the company $2,500 towards the building of a bridge across the river, so that the road, which is to be for freight exclusively, can enter the city. The ANN ARBOR R. R. CO. has the contract for building the bridge. Land for a terminal has been purchased.

NEW YORK, NEW HAVEN & HARTFORD.—The Board of Railroad Commissioners will give a hearing at the Capitol, Hartford, Conn., on Oct. 27 at 11 a. m., on the petition of the N. Y., N. H. & H. R. R. Co. for the elimination of five grade crossings.

NORTHWESTERN PACIFIC.—Contract has been awarded to JAMES H. WILKINS, San Francisco, Cal., for building the cut-off between Corte Madera and Greenbrae, Cal., two miles. W. C. Edes is Ch. Engr.

OKLAHOMA.—The Northwest Oklahoma Development Co. has been organized with $10,000 capital to build a railroad from Oklahoma City through parts of western and

northwestern Oklahoma to a point in Kansas. Application will be made for a charter. The officers are: Pres., W. E. Miller, of Kingfisher; Vice-Presidents, H. W. Side, of Kiel; C. K. Bozman, of Okeene; H. D. Cunningham, of Fairview; W. C. Douglas, of Whitehorse; E. D. Gillespie, of Tioga, and Joe Sherman, of Hoopville; Secy. and Treas., Charles Clarke, of Okeene.

*PHILADELPHA & READING.—We are officially advised that contracts have been let for the following work, for which bids were received on Sept. 16, by W. Hunter, Ch. Engr., 520 Reading Terminal, Philadelphia: Contract No. 31—coal pocket yard at northeast corner of Tenth and Norris Sts. Contract No. 32—masonry, embankment, paving, water and drainage systems and new freight office building in yard between Berks and Morris Sts., west side. Contract No. 35—drainage for yards between York St. and Cumberland St. No. 31—awarded to WM. STEELE & SONS CO., 1600 Arch St., Philadelphia, at $36,181. Other bidders were: Enos L. Seeds, 6314 Wissahickon Ave., $37,816; M. N. Lisowski, 417 Heed Bldg., $44,659; Lynch Bros., 614 Lippincott Bldg., $36,740; Roydhouse, Arey & Co., Fidelity Bldg., $36,597; Blackstaff Engineering Co., 1332 Walnut St., $40,462; Henry E. Baton, 1221 Arch St., $39,212; James McGraw Co., Arcade Bldg., $41,530; Westinghouse, Church, Kerr Co., 10 Bridge St., New York, $39,359; Armstrong & Latta Co., Land Title Bldg., $40,321; all bidders are of Philadelphia, unless otherwise noted.

Contract No. 32—awarded to ARMSTRONG & LATTA CO., at $67,508. Other bidders: John McMenamy, Harrison Bldg., $89,431; Blackstaff Engineering Co., $81,715; Enos L. Seeds, $70,329; McGraw & Gray, 832 North Preston St., $74,922; David E. McMahon, 600 East Chelton Ave., $81,185; James McGraw Co., $74,906; Wm. Steele & Sons Co., $77,675; Roydhouse, Arey & Co., $72,689.

Contract No. 35—awarded to O'TOOLE, WALLS & DEMPSEY, at $2,440. Other bidders: Enos L. Seeds, $3,332; Wm. A. Ryan, 26 South 15th St., $2,972; D. E. McMahon, $3,345; Blackstaff Engineering Co., $3,685; James McGraw Co., $3,788; John McMenamy, $4,657; Downing & Weaver, Bulletin Bldg., $2,874.

PRINCE EDWARD ISLAND R. R.—Bids will be received until Oct. 31, inclusive, for the construction of a branch line from Harmony to Elmira, a distance of ten miles. D. Pottinger, Gen. Mgr., Moncton, N. B.

REGISTER & ROCKY FORD.—Application has been made to charter a railway company in Georgia to build a line from Register to Rocky Ford, 25 miles. Each terminal is on the Central of Georgia Railway. Survey is to be made immediately. Capital, $150,000. The incorporators are G. W. DeLoach, S. T. Ellis, M. A. Smith, D. C. Newton, J. M. DeLoach, L. B. Godbee, P. M. Anderson and W. G. Warnell, of Tattnall County, Reidsville being the county seat; and J. E. Donohoo, J. W. Williams and F. P. Register, of Bulloch County, Statesboro being the county seat.

SANOODY VALLEY.—J. P. Hornady & Co., 32 Cortlandt St., New York, are promoting and constructing this railway between DeKalb and Sucarnoochee, Miss., twelve miles. R. H. Tingley and C. E. Van Bibber, 30 Church St., New York, are the Engrs. Noted on July 16.

ST. PAUL BRIDGE & TERMINAL.—The route between St. Paul, Minn., and the South St. Paul stockyards will be shortened by eight miles by the building of a new railroad line. A company has been incorporated with a capital stock of $500,000. It will be known as the St. Paul Bridge & Terminal Co. Included among the incorporators are William Magivney, Pres. of the Stockyards Terminal Railway Co., John S. Bangs., Mgr. of Swift & Co., and Joseph Strawhorn. The board of directors include Albert R. Fay and Louis F. Swift, of Chicago. The construction of the new line, which will take place as soon as the engineers can locate the line and secure the right-of-way, will involve the building of a new bridge across the Mississippi River.

SOUTHERN UTAH.—Contract has been awarded to the ELY CONSTRUCTION CO., of Springville, Utah, for grading a 7-mile section of the new railway. As noted on Sept. 24 this railway will be 18 miles long, will start at Price, Utah, and follow the water grade of Miller Creek into the coal fields of Carbon County, the purpose of the construction of the road being the development of the coal fields. J. H. R. Franklin, 268 South Main St., Salt Lake City, Utah, is Pres.; J. R. Schreck, Salt Lake City, is Secy.

SOUTH & WESTERN.—See Carolina, Clinchfield & Ohio Ry.

UNION PACIFIC.—TUOHY BROS., Butte, Mont., have been awarded contract it is reported for constructing 80 miles of new railway on the Portland-Tacoma extension.

ELECTRIC RAILWAYS.

LEWISTON, ME.—The new line of the Lewiston, Augusta & Waterville St. Railway, between this city and Augusta, a distance of about 30 miles, was opened on Oct. 13. This company has petitioned the Board of Railroad Commissioners for approval to change the location of its line between Augusta and the town of Vassalboro, on the section running from the corner of Cony St., in Augusta to the east end of the Ticonic bridge in the town of Winslow. Harry B. Ivers is Gen. Mgr., Lewiston.

GOUVERNEUR, N. Y.—We are officially advised that the Northern New York Trolley Co. expects to have surveys made by Nov. 15. After engineers' report is made the company will organize. Anson A. Potter is interested. Noted on Sept. 17.

GENEVA, N. Y.—The franchise of the Geneva Phelps and Newark Ry. to enter the village of Newark, N. Y., has been extended until next year by the Board of Trustees of that village. It is stated construction work on the line will be started early next season.

GARDENVILLE, N. Y.—The Buffalo Southern Ry. Co. has awarded contract for a 6-mile extension to the PINKERTON CONSTRUCTION CO., Land Title Bldg., Philadelphia. This railwy connects Buffalo, Gardenville, Ebenezer, Orchard Park, Armor and Hamburg, 20 miles.

JEANNETTE, PA.—D. W. SPERRY, of Philadelphia, has contract for construction of the Jeannette, West Newton & Monongahela Valley St. Ry.

PITTSBURG, PA.—The Pittsburg & Chester Electric Ry. Co. has been organized with Rev. J. M. Ree, of Pittsburg, Pres.; Rev. A. M. Buchanan, of Morgantown, W. Va., Secy., and J. H. McLarn, of Murdocksville, Pa., Treas. The purpose of the organization is to construct a street car line from Carnegie to Chester, W. Va. The proposed road will start near Carnegie, crossing the Steubenville pike near Beech Cliff, thence down Montour Run to Imperial fair grounds, thence by way of Clifton to the headquarters of the Potato Garden Run, crossing Raccoon Creek at Murdocksville, thence to Wingfield Run, by way of Frankfort Springs and Mill Creek cemetery, and to Chester and thence to East Liverpool, Ohio. Noted last week.

BALFOUR, PA.—The Cumberland Ry. Co. has been chartered to build a 3-mile railway in Cumberland County beginning at Balfour. Capital stock, $12,000. The incorporators are W. E. Gatefelder, of Balfour, Pres.; G. A. Albright, D. W. Sunday, J. A. Ring, and W. F. Pascoe, of Carlisle, Pa., and J. F. Nace and J. Lenker, of Balfour.

MORGANTOWN, W. VA.—Application has been filed with the Secretary of State for the incorporation of the Cheat River Elec. Ry. Co., which proposes to build an electric railway up Decker's Creek by way of Dellslow to Cheat River. This part of the work is expected to begin at once. The road may be extended to Point Marion, Pa., where it will connect with an electric road to be built from Fairchance, Pa. J. H. McDeermott and H. R. Warfield, of Morgantown, are interested.

KEYSTONE, W. VA.—The Keystone Light & Power Co., Keystone, W. Va., has applied for an electric railway franchise to build a line west of Switchback and west of Kimball, 16 miles. Capital has been raised for building an electric railroad from North Fork, W. Va., to Elkhorn, W. Va., and the work will begin as soon as the franchise is secured.

HATTIESBURG, MISS.—The Hattiesburg Traction Co. may resume construction on its local system in December. Company will erect power station. C. Z. Stephens is Gen. Mgr., Hattiesburg. Company operates seven miles of track.

DAYTON, OHIO.—The Dayton, Springfield & Xenia Southern Ry. Co. has been incorporated to build an electric railway from Xenia to Wilmington and later to Cincinnati. Capital stock, $10,000. T. A. Ferneding, of Dayton, is Pres.; R. J. Wells, Vice-Pres.

FRANKFORT, IND.—The City Council has passed the ordinance granting to the Kokomo, Frankfort & Terre Haute Traction Co. a right-of-way through Frankfort. The franchise is for 35 years and stipulates that the road must be in operation between Frankfort and Kokomo two years from Jan. 1, 1909.

EVANSVILLE, IND.—The Evansville & Southern Indiana Traction Co. is surveying the proposed extension from Patoka to Hazleton, Ind. F. M. Durbin, Gen. Mgr. Evansville.

TERRE HAUTE, IND.—The Terre Haute, Indianapolis & Eastern Traction Co. may build an extension from Shelburn to Hymera, Ind.; six miles. H. E. Smith is Ch. Engr.

SPRINGFIELD, ILL.—The City Council has granted the Springfield, Clear Lake & Rochester Interurban Ry. Co. a franchise, giving the company the right to operate interurban cars over the tracks of the Springfield Consolidated Railway on Monroe, Sixth, Washington, Fifth, 15th Sts. and Capital Ave. J. E. Melick is Pres. Company will build an extension to Hillsboro.

CHICAGO, ILL.—Construction is under way on the proposed Chicago, Wheaton & Western Ry. It will connect Chicago and West Chicago. Capital, $10,000. Headquarters, 707 Rookery Bldg., Chicago. Officers: Henry C. Wood, Pres.; Roy B. Tabor, Vice-Pres.; M. E. Anderson, Secy.; J. Sidney Condit, Treas., all of Chicago. I. W. Thoxel, Rookery Bldg., Chicago, is Ch. Engr.

DES MOINES, IOWA.—The Des Moines, Winterset & Creston Electric Ry. Co. has let contract to the INTERURBAN CO., 25 Broad St., New York, for building its proposed line from Des Moines to Creston, Iowa. The financing of the enterprise is nearing completion. Actual construction will be begun ssoon. I. H. Hixson, of Des Moines, is Gen. Mgr. Noted on March 19, 1908.

DES MOINES, IOWA.—T. J. Avery, Pres. of the Chicago, Ottumwa & Western Ry. Co., Hamilton, Iowa, advises us that construction contracts will not be let until next spring. Surveys are partly made and considerable right-of-way obtained. About 75% of capital for construction has been secured. The line will be 90 miles long, connecting Des Moines with Ottumwa. F. R. Hoar, Hamilton, Iowa, is Ch. Engr. Noted on Aug. 27.

SIOUX CITY, IOWA.—WESTINGHOUSE, CHURCH, KERR & CO., 10 Bridge St., New York, have contract for building the Sioux City & Spirit Lake Ry. from Sioux City to Spirit Lake, Iowa. The officers are Frank Patch, Pres.; George Coleman, Secy.; G. E. Knaak, Treas.; E. A. Burgess, Chief Counsel; L. F. Wakefield, Ch. Engr.; J. D. Browning, Gen. Mgr., Sioux City. Officially noted on Feb. 27, 1908.

OMAHA, NEB.—The Omaha, Lincoln & Southeastern R. R. Co. has been incorporated to build an electric line between Omaha and Lincoln. Capital stock, $100,000. Incorporators: Ellery S. McNaul, L. Howard Brumbaugh, I. G. Ladd, F. H. Rile, G. E. Moffat, Stephen St. John Malvern, all of New York; Nicholas D. Pound, of Chicago; De V. Sholes and Charles L. Dundey, of Omaha.

RAPID CITY, S. DAK.—The Rapid City & Wyoming Ry. Co. has been incorporated in South Dakota to purchase or construct a line from Rapid City to Mystic, a distance of 35 miles. Headquarters will be at Rapid City. Capital stock, $500,000. Incorporators: H. W. Jones, H. E. Swandler, L. A. Richards, J. C. Haines, E. M. Reeves, F. H. Rugg, G. P. Bennett, W. F. Pascal and Thomas Sweeney, all of Rapid City, S. Dak.

SPRINGFIELD, MO.—W. A. Bixby, Gen. Mgr., of the Springfield Traction Co., advises us that surveys are now being made for the proposed railway to connect Springfield and Carthage, Mo. It will be between 55 and 70 miles long, depending upon the route selected either a direct line or by way of Republic, Aurora, Monett and Pierce City. Right-of way is partly obtained. Contracts will be let probably in 60 or 90 days.

MANSFIELD, MO.—We are officially informed that the OZARK SOUTHERN CONSTRCTION CO., Mansfield, Mo., which has the contract for building the Kansas City, Ozarks & Southern Ry. from Mansfield to Ava., Mo., 15 miles, has graded 85% of the line; five miles, of track are laid, steel is on hand for four miles additional and the balance is on the way. Surveys are made and right-of-way and capital secured. Albert Parker is Pres., Kansas City; J. B. Quigley is Ch. Engr., and Geo. W. Wilhelm, Secy., Mansfield. Noted fully on July 30.

EL PASO, TEX.—Richard Caples and W. B. Latta have been granted a franchise to build an interurban railway from El Paso to Fabens, in the Rio Grande Valley, 32 miles. The line will connect the towns of Orns Grove, Ysleta, Sorocco, Clint, San Elizario and Fabens. Noted last week.

CORSICANA, TEX.—J. V. Watkins, Pres. Corsicana-Palestine Interurban Ry. Co., advises us that the company intends to construct a railway 60 miles long betwen Corsicana and Palestine, Tex., all new work. Surveys have been made and right-of-way secured. Contracts will be let after Jan. 1. G. A. Duren, Corsicana, is Ch. Engr.

TYLER, TEX.—This city presents an inviting field for a street railway and correspondence is solicited with parties interested in the construction of such a line. Address John H. Bonner, the Mayor.

ALAMEDA, CAL.—The City Council has passed a resolution granting to the Southern Pacific Co. a franchise to convert motive power of its suburban system from steam to electricity and to construct and operate a new line encircling the east shore of the city.

SACRAMENTO, CAL.—The California Central Traction Co., operating an electric line between Stockton and Lodi, has applied to the City Trustees for a franchise to enter Sacramento.

FRESNO, CAL.—The Fresno, Hanford & Summit Lake Interurban Ry. Co. will build a standard-gage electric railway from Fresno, passing through Calma, Malaga, Fowler, Selma, Kingsburg and Laton, the southern terminus being Hanford. The line will pass through a fruit raising district. It will be about 40 miles in length. The overhead trolley system will be adopted. It is planned to build the main power station at Kingsburg and the substations at Malaga and Laton, and also plans to build and operate two amusement resorts, one at Laton and the other on Kings River, a few miles east of Laton. Capital stock, $1,000,000. Construction work probably will be commenced this year. Contracts have not been awarded yet. Officers: L. A. Nares, Fresno, Pres.; F. S. Granger, Hanford, Vice-Pres. and Gen. Mgr.; J. D. Biddle, Hanford, Secy.; H. A. Beekhuis, Hanford, Treas.; Chadwick & Sykes, San Francisco, are Ch. Engrs.

LIGHT AND POWER PLANTS.

(* *denotes that this work is advertised in Engineering News.*)

BOSTON, MASS.—Bids will be called for soon by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for machinery in the electric generating plant of the Boston Navy Yard, to cost about $50,000.

Bids were received on Oct. 3 by Lieut.-Col. Edward Burr, Corps Engrs., U. S. A., for junction boxes and cable as follows: Junction boxes; National Electrical Supply Co., Washington, D. C., $3,697; Hoisting Machinery Co., New York, N. Y., $5,505; G. & W. Mfg. Co., New York, N. Y., $1,585; General Electric Co., Schenectady, N. Y., $3,571; Standard Underground Cable Co., Pittsburg, Pa., $6,954; Western Electric Co., Boston, $3.514. Cable: Waterbury Co., New York, N. Y., $23,613; General Electric Co., Schenectady, N. Y., $17,307; Safety Insulated Wire Cable Co., New York, N. Y., $23,301; Simplex Electrical Co., Boston, $19,679; Standard Underground Cable Co., Pittsburg, Pa., $20,251.

The following are the bids opened Oct. 10 at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for two boilers, with superheaters and stokers, one self-supporting steel stack and connecting flue, for the Navy Yard, Boston, specification 1600, (a) for boilers, stokers, superheaters and appurtenances complete, according to plans and specifications; (b) for stack only, according to plans; (c) for stack, according to general requirements of specifications, but with modifications; (d) for complete work in accordance with spirit of specifications, but with modifications: Babcock & Wilcox Co., New York, (a) $21,227, (b) $9,705, (c) $7,000, (d) $19,487 (B. & W. boilers) and $19,337 (Stirling boilers). Edgemoor Iron Co., Edgemoor, Del., (b) $9,000, (d) $30,500. Heine Safety Boiler Co., 1120 Pennsylvania Bldg., Philadelphia, Pa., (b) $9,000, (c) $7,796, (d) $29,874. H. R. Heinecke, Inc., 147 Fourth Ave., New York, (c) $6,398. The Weber Co., 20[illegible] Dearborn St., Chicago, Ill., (c) $6,275. [illegible]ner Chain Grate & Construction Co., [illegible]mical Bldg., $3,150 (for stokers only). A[illegible]s Custodis Chimney Construction Co., Nassau St., New York, N. Y., (c) $7,18[illegible] $7,000. A. D. Granger Co., 90 West St., New York, N. Y., (a) $37,914. E. Keeler [illegible] 238 West St., Williamsport, Pa., (a) [illegible] (b) $8,500, (c) $7,808, (d) $29,184, [illegible] $29,140 with various alternate bids.

NEW HAVEN, CONN.—Pl[illegible] supply illumination to the buildings [illegible] Yale University from a central electric li[illegible] plant belonging to the university h[illegible] been completed, it is reported, and wi[illegible] carried into effect soon. The ultimate pu[illegible] is to supply electricity to all of the [illegible]dings used by the university and the d[illegible]tories from this plant, except in such c[illegible]s individual buildings have their own [illegible]ate plants. The plant of the Yale Dinin[illegible] Hall and the Sheffield Scientific School equ[illegible]nt will be used for this purpose, after [illegible]in necessary changes and additions h[illegible] been made. It is estimated that Yale wi[illegible] spend about $50,000.

* NEW YORK, N. Y.—One bi[illegible]s received on Oct. 15 by the Park Board, [illegible]ry Smith, Pres., for furnishing and installing electric lighting fixtures in the new a[illegible]on (E) of the Metropolitan Museum of A[illegible], located in Central Park, on the west side [illegible] Fifth Ave., opposite 83d St., Boro. of Manhattan: The Sterling Bronze Co., 107 W[illegible] 25th St., $6,970.

NEW YORK, N. Y.—See item under Buildings.

CANANDAIGUA, N. Y.—The Board of Water Commissioners has requested an appropriation of $35,000 to be used for installing two motor driven centrifugal pumps, 2,500,000 gals. capacity each. Bids will be asked by the Board of Water Commissioners as soon as the appropriation is granted. Electric power from the Ontario Light & Traction Co. will be used to operate the pumps.

HUDSON, N. Y.—The Albany & Hudson R. R. Co. will enlarge its power station at Stuyvesant Falls, additions being necessary to provide for increasing business and for emergencies. The company has appropriated $75,000 to cover the cost of this new work. R. P. Leavitt, Elec. Supt., Albany.

RIVERHEAD (L. I.), N. Y.—MURALT & CO., 114 Liberty St., New York, have secured the contract for the enlargement and improvement of the hydro-electric plant of the Riverhead Electric Co., at Riverhead. The old water wheels now in use will be taken out and new Trump turbines of the vertical shaft type will be installed. The electric equipment will be of the three-phase alternating current type with a frequency of 60 cycles per second and 1,100 volts. There is also an auxiliary steam plant for emergency purposes.

QUITMAN, GA.—It is proposed to install a 50-light a.-c. series system and two 200-HP. boilers at the municipal electric light plant. J. D. Wilson is Mayor.

LEESBURG, FLA.—Bids are asked by the city until Oct. 23 for electric light and water franchise. L. M. Johnson is Clk.

JACKSONVILLE, FLA.—The following bids were received by the Board of Bond Trustees on Oct. 5 for automatic stokers for the ten steam boilers in use at water-works and electric light plant: Rosedale Foundry & Machine Co., Pittsburg, Pa., $10,365; Underfeed Stoker Co., of America, $14,200, and the Lenher Engineering Co., New York, N. Y., $20,925.

PENSACOLA, FLA.—ROBT. L. GRAVELEY, P. O. Box 344, has contract for dams to be constructed to secure power for a 7-mile trolley line; probable cost of work, $100,000. Nothing will be done until franchise is secured. Louis Boley, of Pensacola, is owner.

CAMBRIDGE, OHIO.—The Ohio Fuel Supply Co. is planning to construct a gas pipe line from Zanesville to Cambridge to connect with the Sugar Grove line at South Zanesville. The estimated cost of this pipe line is $200,000. Three months would be required to complete the work. According to the present plans, the line will connect with the Sugar Grove main leading into Zanesville near the Peters & Reed Pottery, South Zanesville. Its course will be across the Muskingum River below the Mark Mfg. Co.'s plant and thence northeast to what is known as the "base" line, which divides Muskingum County in halves and which runs east and west. This line will be followed through Guernsey County and connect with a main eight miles south of Cambridge leading from the Valley Township field in Guernsey County. Its entire length would be 23 miles. H. H. Driebelbis, Zanesville, is Gen. Mgr.

RICHWOOD. OHIO.—Bids will be received until Oct. 24, by Ray L. Jordon, Village Clk., for lighting the streets of the village with not less than 35 arc lamps of not less than 2,000 c.-p., for a period of ten years, from Nov. 1, 1908.

INDIANAPOLIS, IND.—Bids are asked until Oct. 28, by the County Commissioners for furnishing heat, light and water from the county power-house to the jail and courthouse.

DANVILLE, IND.—The Danville Light, Heat & Power Co. has purchased a new site upon which to construct and equip a plant. The building will be of steel, brick and cement, 50 × 140 ft. Bids will be received soon.

EAST ST. LOUIS, ILL.—W. H. Hauss and others, representing the Consumers' Light & Power Co., have petitioned council for a franchise to build conduits, erect poles and supply electricity in the downtown district.

ATLANTIC, IOWA.—The STACEY MFG. CO., of Cincinnati, Ohio, has secured contract for the gas holder, and the WESTERN

GAS CONSTRUCTION CO., of Fort Wayne, Ind., for the water gas set for the Red Oak Gas Co. F. A. Kidder, Mgr. Bids were received on Oct. 8.

RED WING, MINN.—A. L. Abbott, of St. Paul has completed his report on placing underground the wires of Red Wing Gas, Light & Power Co., and estimates the cost at $31,440. W. R. Putnam is Mgr.

FARIBAULT, MINN.—The Polar Star Electric Co. has decided to expend about $150,000 in improvements, it is stated. The Northern Heating & Electric Co., of St. Paul, is interested.

TOPEKA, KAN.—Bids are asked until Oct. 28 by Charles E. Denton, Secy., of the Executive Council, at Topeka, for furnishing and installing in the State House heat and power plant two electric generators, of 30 KW. each, windings to be for 121 volts at no load and 125 volts at full load. Allowance to be made for old generators, including removal.

TOWNSEND, MONT.—We are officially advised that the municipal electric light plant will be increased by a 75-KW., single-phase, 60-cycle, alternating-current generator, with pulley and exciter. H. M. Ogden is Mgr. City Electric Dept. The contract has been let to the ELECTRIC MACHINERY CO., Minneapolis, Minn.

BOULDER, COLO.—The Central Colorado Power Co. will extend its transmission line to the mining districts of Boulder County. The main line, extending from Boulder to Nederland, will be completed and carrying power to the construction camps of the Eastern Colorado Power Co. this month, the current being supplied from the Lafayette power station of the Northern Colorado Power Co., which will furnish the current until the completion of the Eastern Colorado plant. The Eastern Colorado Power Co. is a subsidiary of the Central Co., which is constructing the great plant at Shoshone and is owner and operator of hydro-electric power plants in various parts of the state. The Boulder plant of the Eastern Colorado Co. which will develop an initial capacity of 10,000 KW., and will ultimately be brought up to 30,000HP., will represent an expenditure of $2,500,000. P. H. Humphrey is Engr.

EDMONDS, WASH.—The Edmonds Electric Light & Power Co. has purchased a site for its proposed plant. An electrician is on the ground. A 200-HP. steam plant will be installed. Coal and oil will be used for fuel. The capacity of the initial plant will be 1,500 lights. Cost, $10,000.

SPOKANE, WASH.—The Washington Water Power Co., of this city, has awarded a contract to the I. P. MORRIS CO., of Philadelphia, Pa., for the installation of water wheels The set consists of four wheels, each weighing 650,000 lbs. and each having a capacity of 9,000 HP. with a head of water of 68 ft. The plant will be built on the Spokane River, 15 miles west of Spekane, to furnish electric light and power for towns in this vicinity.

TURLOCK, CAL.—The La Grange Water & Power Co. is reported to have secured franchise to build an electric lighting and power system at Turlock. The system is to be completed within six months.

GREENVILLE, CAL.—O. C. Pratt will order machinery at once for a power plant to supply services to Greenville and Indian Valley. The articles of incorporation of the Indian Valley Electric Light & Power Co. are prepared and will be filed at once. Actual work of wiring will commence as soon as material can be delivered at Greenville, which probably will be within two weeks.

RAWHIDE, NEV.—F. O. Broili, Engr. of the Truckee River General Electric Co., and Walter E. Trent, Engr. for the Nevada Machinery & Supply Co., have completed the survey of a power line from a point on the Truckee River General Electric Co. lines near Yerington, to Rawhide. In the meantime these two engineers will build a local plant and run it with gasoline engines.

OGDEN, UTAH.—Contract has been awarded the J. P. O'NEILL CONSTRUCTION CO., of Ogden, by the Utah Light & Railway Co. for the installation of a pipe line in Weber Canyon in connection with the new power plant now under construction. Estimated cost, $90,000.

WALLACE, IDAHO.—The Spokane (Wash). "Spokesman-Review" states that between $2,500,000 and $3,000,000 will be spent on construction of a power line from Thompson, Mont., to the Murray district. Arrangements have been made for financing and construction will soon begin. The plant will furnish power to the north side mines. The line from Thompson to Murray will be about 31 miles in length.

TORONTO, ONT.—The Board of Control has appointed Alexander Dow, of Detroit, Mich., as consulting engineer in connection with the construction of the proposed electric distributing plant.

ATOTONILCO, MEXICO.—We are officially advised that the Atotonilco Light & Power Co. has been organized in Guadalajara with a capital of $50,000 to install a hydro-electric plant and furnish light and power to the town of Atotonilco and to haciendas and industrial plants in the tributary territory. Atotonilco is the center of the orange district of Jalisco. The officers of the new company are Enrique Alvarez de Castillo, Pres.; Francisco Munoz, Vice-Pres.; Alfredo Gonzales, Secy.; Jose M. Corvera, Treas., and Alfredo Gallardo, Gen. Mgr. The other stockholders are Manuel Cuesta Gallardo, Dr. Felipe Valencia, Carlos Hering, Vincente Orendain, Fred M. Newton, Jose C. Diguez and Dr. Carlos Barriere. For the generation of electric current the new company will use the Faretan waterfall near the town of Ttotonilco. The water drops a distance of 75 ft., and power sufficient for all needs in that section can be developed. Cost, $30,000. Bids will be received about Jan. 1 for construction of plant.

TORREON, MEXICO.—Plans are under way for an irrigation and hydro-electric proposition in Mexico, the Government having agreed to give financial assistance. The dam will be built across the Nazas River, 100 miles southwest of Torreon, and Government engineers have been making surveys and estimates for several months. According to these estimates, the dam will cost about $6,000,000 gold, to build. It will afford a water supply for the whole Nazas River cotton-growing district for a period of three years without replenishing. In connection with the dam, it is planned to install a hydro-electric plant which will generate enough electric power to supply all the towns within a radius of 150 miles. In the Nazas River valley, lies the principal cotton-growing region of Mexico. Owing to the uncertainty of rains in the mountains, the Nazas River cannot be depended upon to give an adequate water supply for irrigation purposes when most needed. By storing the water this difficulty will be overcome. The contract for building the great dam has been awarded to S. PEARSON & SONS, of London, England.

BRIDGES.

(denotes that this work is advertised in Engineering News.)*

LAWRENCE, MASS.—The City Council has authorized a loan of $500,000 for the construction of Central Bridge. John P. Kane is Mayor; John Breen is Chn. Bridge Comn.

NORTH TONAWANDA, N. Y.—Plans have been prepared for a 2-span bridge to be constructed over the Erie Canal at North Tonawanda for the New York Central R. R. Co. C. W. Kittredge is Ch. Engr., New York.

WILKES-BARRE, PA.—Bids are asked until 2 p. m., Oct. 26, by James M. Norris, County Controller, for the construction of a steel and concrete bridge in Butler Township.

PHILADELPHIA, PA.—Bids for the construction of a reinforced concrete arch bridge with a span of 70 ft. on the line of Fox St. over the Richmond branch of the Philadelphia & Reading Ry., 38th Ward, were opened by the Department of Public Works on Oct. 14. The bids were twelve in number, and were as follows: Millard Construction Co., Pennsylvania Bldg., $27,000; Tomlinson Paving & Construction Co., 3024 Chestnut St., $40,500; Thomas H. Riddle, $29,950; Thomas F. Reilly, $32,913; McNichol Paving & Construction Co., $29,493; W. W. Lindsay & Co., Harrison Bldg., $33,900; R. P. Benniss, 24th and Westmoreland Sts., $29,400; Richard Walsh, $27,937; David Peoples, Betz Bldg., $30,200; Cramp & Co., Commonwealth Bldg., $33,200; McGaw & Gray, $30,900; John McMenamin, $31,539. George R. Sterns is Dir. Pub. Wks.

KEEDYSVILLE, MD. — The Washington County R. R. Co., a branch of the Baltimore & Ohio R. R. Co., Oscar G. Murray, Pres. B. & O. Bldg., Baltimore, Md., is considering the erection of a bridge over Antietam Creek near Keedysville.

ODESSA, DEL.—Bids for constructing a bridge over Silver Run, in St. George's Hundred, were opened on Oct. 13, by the Levy Court. This bridge is on the road leading from Port Penn to Odessa. The bids follow: Tatnall-Brown Co., $5,350; Harrigan & Co., $4,655; Joseph F. Bradley, $3,300; Naudain & Jones, $4,480; Joseph Anderson, $3,799; Taylor & Morrison, $3,634.

*LYNCHBURG, VA.—Plans and specifications are on file at the office of Engineering News, New York, for placing new stringers under street car tracks, and lacing top chords, Rivermont Viaduct. The approximate quantities of the work to be done are as follows: 101.5 tons channels in stringers, 6.4 tons lace bars; 18,260 ft. B. M. lumber. Bids are asked until Oct. 26.

GREENVILLE, S. C.—The city will construct a bridge across the Reedy river. Estimated cost, about $25,000.

SPARTANBURG, S. C. — Spartanburg County will expend about $150,000 in replacing bridges damaged by flood and other work.

MONTGOMERY, ALA.—A. A. Gilchrist, City Engr., has approved the plans submitted by B. B. Smith, Arch., 22½ Perry St., Montgomery, for the proposed reinforced concrete bridge to be constructed over the railway tracks on Madison Ave. to replace the present steel structure. The plans call for a 3-span bridge, with two supports, roadway being 50 ft. wide.

LEBANON, TENN.—Wilson County has awarded the contract to the NASHVILLE BRIDGE CO., Nashville, Tenn., for constructing two steel bridges across Barton's Creek and Smith's fork, one to be 140 ft. long and the other 175 ft. Estimated cost, about $4,000.

LINDEN, TENN.—Perry County has decided to construct a bridge across the Buffalo River.

WEST POINT, KY.—The Fiscal Courts of Jefferson and Hardin Counties will erect a steel bridge over Salt River at West Point. Estimated cost, $35,000.

TOLEDO, OHIO.—Bids will be received until Nov. 11 by the County Commissioners, Toledo, L. B. Bailey, Chn., for constructing the substructure of a bridge over Swan Creek in Adams Township; also for constructing the superstructure of said bridge. Bids, including bidders' own plans, will also be considered. Separate bids for the superstructure are required.

CLEVELAND, OHIO.—Bids will be received by the Board of Commissioners of Cuyahoga County, until 11 a. m., Nov. 11, for the construction of a retaining wall and a concrete bridge. A. B. Lea is County Surv.

PHILO, OHIO.—Bids will be received by the Commissioners of Muskingum County, Zanesville, Ohio, until noon, Nov. 2, for furnishing all the material and performing all the labor or part thereof, at the option of the bidder, necessary for the construction of a concrete abutment at the west end of river swing bridge, at Philo, Muskingum County, Ohio, in accordance with plans and specifications and estimates on file in the office of the county auditor. L. E. Brelsford is County Audr.

CINCINNATI, OHIO.—We are officially advised that bids were received as follows on Oct. 12 by the Board of Trustees of the Cincinnati Southern Ry. Co. for the construction of the superstructure of the viaduct for the terminal track from Enghth St. and McLean Ave. to Third and Front Sts.: (a) 75,000 lbs. deck girders connected to present girders, steel superstructure; (b) 3,471,000 lbs. deck plate girders; (c) 372,000 lbs. through-plate girders, square ends; (d) 608,000 lbs. through-plate girders skew ends; (e) 600,000 through riveted span; (f) 80,000 lbs. steel bents; Strobel Steel Construction Co., Monadnock Bldg., Chicago, Ill.: (a) 3.78 cts.; (b) 3.18 cts.; (c) 3.33 cts.; (d) 3.48 cts.; (e) 3.53 cts.; (f) 3.78 cts.; Fort Pitt Bridge Works, House Bldg., Pittsburg, Pa., (a) 3.35 cts.; (b) 3.25 cts.; (c) 3.22 cts.; (d) 3.27 cts.; (e) 3.70 cts.; (f) 3.50 cts.; McClintock-Marshall Construction Co., Park Bldg., Pittsburg, Pa.: (a) 4.11 cts.; (b) 2.98 cts.; (c) 3.47 cts.; (d) 3.52 cts.; (e) 4.76 cts.; (f) 3.65 cts.; Mount Vernon Bridge Co., Mount Vernon, Ohio: (a) 3.95 cts.; (b) 3.35 cts.; (c) 3.50 cts.; (d) 3.65 cts.; (e) 3.70 cts.; (f) 3.95 cts.; Riter Conley Mfg. Co., 55 Water St., Pittsburg: (a) 3.08 cts.; (b) 3.08 cts.; (c) 3.26 cts.; (d) 3.35 cts.; (e) 3.47 cts.; (f) 3.39 cts.; American Bridge Co., New York, (a) 3.99 cts.; (b) 3.09 cts.; (c) 3.39 cts.; (d) 3.57 cts.; (e) 4.08 cts.; (e) 4.08 cts.; The Pennsylvania Steel Co., Steelton, Pa., (a) 3.65 cts,; (b) 3.13 cts.; (c) 3.30 cts.; (d) 3.45 cts.; (e) 3.80 cts.; (f) 3.65 cts.; Granger & Co., Louisville, Ky., (a) 4.00 cts.; (b) 3.55 cts.; (c) 3.75 cts.; (d) 3.75 cts.; (e) 4.25 cts.; (f) 4.25 cts.; The Toledo-Massillon Bridge o., Toledo, Ohio: (a) 3.95 cts.; (b) 3.26 cts.; (c) 3.45 cts.; (d) 3.46 cts.; (e) 3.75 cts.; (f) 3.50 cts. Ward Baldwin is Ch. Engr.

CLIFTY, IND.—The Commissioners of Decatur County, Greensburg, will soon ask for bids for the construction of a bridge over Haw Creek at Clifty. Estimated cost, $8,000.

GREENFIELD, IND.—Bids are asked by the Commisssioners of Hancock County until 10 a. m., Nov. 2, for the construction of a bridge over the section line creek. Charles H. Troy is County Audr.

PERU, IND.—Commissioners of Miami County have awarded contracts for the construction of twelve bridges as follows: To the ROCHESTER BRIDGE CO., four; the ELKHART BRIDGE & IRON WORKS CO., two; LUTHER KESING, two; DANIELS & DANIELS, two; and JOSEPH R. HOOVER, two There were seven bidders. The totals of the bids were $77,825.

OTTAWA, ILL.—We are officially advised that bids were received on Oct. 13 by the city for the construction of the Illinois River bridge here. Contracts were awarded as follows: Superstructure steel work: The MODERN STEEL STRUCTURAL CO., Waukesha, Wis., at $63,490; substructural work: The A. M. BLODGETT CONSTRUCTION CO., 5 Water-Works Bldg., Kansas City, Mo., at $19,559.

MILWAUKEE, WIS.—The Board of Public Works will repair the Sixteenth St. viaduct at a cost of $50,000. Chas. G. Poetsch is City Engr.

IOWA FALLS, IOWA.—THE DES MOINES BRIDGE & IRON CO., Des Moines, Iowa, was awarded the contract on Oct. 7 by the St. Paul & Des Moines R. R. Co. for the construction of a steel bridge across the Iowa River here. The bridge will be of plate girder span construction. The steel spans to be 100 ft. in length. The bridge will be 500 ft. in length and will require five of these spans. The bridge at its highest point will be 75 ft. from the ground. The abutments and piers will be of concrete.

LINCOLN, NEB.—Bids are asked until 2 p. m., Nov. 2, by W. L. Dawson, County Clk., for the construction and completion of a reinforced concrete culvert, to be built on O St., near 36th St., culvert to be built in strict accordance with plans and specifications adopted by the Board of County Commissioners and now on file in the office of the County Clerk.

ST. LOUIS, MO.—Andrew J. O'Reilly, Pres. Bd. Pub. Improvements, has submitted plans for piers of the proposed free bridge. The plans call for four piers, 500 ft. apart to be completed within 20 months. Estimated cost, $666,277.

MAGAZINE, ARK.—Logan County will construct a steel bridge across Scott's Creek and complete steel bridge across Petit Jean River, near Magazine.

MARIANNA, ARK.—Bids will be received at the office of the County Court Clerk until 2 p. m., Nov. 18, for the construction of a steel highway bridge, 450 ft. long, across the L'Anguille River, at Marianna. Plans and specifications may be seen at the office of the County Court Clerk, or will be furnished prospective bidders by H. N. Pharr, Consulting Engr., 216 Randolph Bldg., Memphis, Tenn.

CHICKASHA, OKLA.—The contract for 20 bridges to be constructed in Grady County was let on Oct. 6 to the HENNEPIN BRIDGE CO., of Minneapolis, Minn., by the County Commissioners, at $38,340. Four of the bridges will be constructed of steel and will span the Washita River in the county. One on the river will be directly north of Chickasha, one near Alex, one in the vicinity of Verden and one near Bradley.

LAS ANIMAS, COLO.—Bids will be received until Oct. 24 by T. W. Jaycox, State Engr., Denver, for constructing a bridge over Las Animas River, near Las Animas, having a 100-ft. span, and for dismantling, transporting and re-erecting on new site the 90-ft. span now at Hilton, Bent County.

SPOKANE, WASH.—The Board of Public Works has decided to reject all bids for a new steel bridge at East Oliver Ave. The action of the board followed a request from the Burrell Bridge & Construction Co. of Oakland, Cal., low bidders, that the company's check be returned. A. Burrell, Contracting Agt. for the company, appeared before the board and said that the company felt that it could not consistently wait longer for the contract to be awarded.

ONTARIO, ORE.—The contract has been awarded to the INTERMOUNTAIN BRIDGE & CONSTRCTION CO. for a combination steel and wood bridge across the Snake River. Bids ranged from $13,500 to $27,000.

HIGHLAND, CAL.—Bids are asked until Oct. 25 by the County for the construction of the sub and superstructure of a bridge on Highland Ave. M. L. Cook is County Surv.

BRANDON, MAN.—The city has awarded the contract to the DOMINION BRIDGE CO., Liverpool & London & Globe Bldg., Montreal, Que., for a steel bridge to be erected here at $27,288.

BUILDINGS.

(denotes that this work is advertised in Engineering News.)*

TYRINGHAM, MASS.—The contract will be let soon for a residence to be erected here for Robb de Peyster Tytus, to cost, including furnishings, $100,000. Francis B. L. Hoppin, of New York, N. Y., is Arch.

CHELSEA, MASS.—The Board of Control has awarded contract for the construction of the Williams District school building to THE WILTON R. HAYNES CO., 35 Federal St., Boston, Mass., for $138,500. This was the lowest offer received by the Board. The other bidders were as follows: J. J. Cadigan & Son, $153,647; J. J. Prindville Co., $142,418, and Anthony Vernerin, $144,935; all Boston contractors. At the same time the contracts for the heating system and plumbing for the new building were awarded. The former to JAMES P. DWYER, 25 Cambria St., Boston, and the latter to THOMPSON & SPEAR, of 30 Oliver St., Boston. The price for the heating plant is $16,966, and for the plumbing, $5,977, to which will be added $369 if some provisional extra work is ordered.

KINGSTON, R. I.—The Board of Managers of the Rhode Island College of Agricultural and Mechanic Arts at Kingston, has accepted the plans submitted by Leslie P. Langworthy, Arch., of Providence, R. I., which provide for a building to be used for dormitory, assembly hall and dining room purposes and to cost about $43,000.

MOUNT VERNON, N. Y.—The contract for erecting an addition to the public library has been awarded by the Board of Education to AMSTERDAM BUILDING CO., 43 West 27th St., New York. Edward L. Tilton, 32 Broadway, New York, is Arch.

ELMIRA, N. Y.—Bids are asked until Oct. 26 by Henry Melville, Pres. Bd. Mgrs., New York State Reformatory, Elmira, for forced draft system for boilers at the reformatory. Franklin B. Ware is State Arch., Albany.

WHITE PLAINS, N. Y.—Bids are asked by F. A. McNeely, Secy., State Bd., of Armor Commissioners at the capitol, Albany, until Nov. 10 for construction, including heating, plumbing, electrical work and gas piping, for the State Armory at White Plains.

OTISVILLE, N. Y.—Bids are asked until Oct. 28 by the Department of Health, New York City, Thomas Darlington, M. D., Pres.; for furnishing labor and materials necessary to install plumbing and heating systems in certain buildings on the grounds of the Tuberculosis Sanatorium at Otisville, Orange County, N. Y.

NEWBURGH, N. Y.—Contract has been let to GEORGE SYKES, 1123 Broadway, New York, for constructing, complete, including heating, plumbing and electric work, a museum building at Washington's Headquarters. Franklin B. Ware, State Arch., Albany.

EASTVIEW, N. Y.—The bids received on Oct. 1 by Eberhard J. Wulff & Co., Consult. Engrs., Tarrytown, N. Y., for erecting an almshouse dormitory at Eastview for the Committee on Poor House and Asylums of the Bd. of Superv., have been rejected. The bids received were as follows: Deakin & Remsen, Mt. Kisco, $43,700; George Murtz Sons, Port Chester, $36,300 and Galgano Bros., New Rochelle, $34,500.

NEW YORK, N. Y.—An apartment house is to be built on Hopkins Ave., at the corner of Temple St., Long Island City, by the Progress Construction Co., of Manhattan, at a cost of $40,000. The size of the building will be 40 ft. front with a depth of 85 ft. and five stories high. The building will be of brick. There will be apartments to accommodate 28 families.

Bids will be received until Oct. 27 by Lawrence Gresser, Pres. Boro. of Queens, for erecting a public comfort station in the Borough of Queens.

Plans have been filed for a 6-story apartment house to be built for the Birch Realty Co., Henry Raabe, Pres., at the corner of Audubon Ave. and 183d St. It is to be of brick and limestone, of Renaissance design, having a frontage of 104.11 ft. and depth of 90 ft. It will contain 30 suites of apartments, and is to cost $150,000.

The Municipal Art Commission has approved designs for a pavilion for the proposed tuberculosis infirmary on Blackwell's Island, to cost $300,000. It will be a 4-story building, with the walls constructed of rubble masonry, to harmonize with those existing buildings which are to be retained as parts of the ultimate development of the work. The building will constitute the northwest pavilion of the new tuberculosis infirmary, and will be on the river bank, about 300 ft. south of the main building of the Metropolitan Hospital. The Commission has also approved design for an electric sub-station at the west pier of the new Blackwell's Island Bridge, to cost $10,000; a subway entrance in the small parkway in Delancey St. on the loop, to cost $12,000, and five marquisses, or covered ways, to subway entrances through private property at the Bowery and Canal St. stations on the loop, to cost $1,900 each.

NEW YORK, N. Y.—Bids were received on Oct. 14 by the Department of Public Charities for furnishing all the labor and materials required for the erection and entire com-

pletion of two fire escapes on school for Feebleminded Children, and iron balconies on the North Hospital, Ward 15, and Old Pavilion A. B. C. at the New City Children's Hospitals and Schools, Randall's Island. The contract was awarded to the lowest bidder, A. S. TAUB, 215 West 125th St., at $12,780.

Bids were opened on Oct. 15 by Louis F. Haffen, Pres. Boro. of The Bronx, for furnishing labor and materials required for the erection and completion of a stable building, wagon house, and tunnel for the use of the Bureau of Highways of the Borough of the Bronx, to be erected on the plot of land situated on the north side of East 182d St., bounded by Webster Ave. and Park Ave., in the Borough of The Bronx. The contract was awarded to GUIDONE & GELARDI, 1 Madison Ave., New York, at $38,500.

NEW YORK, N. Y.—Bids were received on Oct. 20 as follows by the Department of Correction for furnishing all the labor and materials required for erection and entire completion of the improvements to the City Prison, Borough of Brooklyn, situated on the southwest corner of Raymond and Willoughby Sts., Borough of Brooklyn, New York: George F. Driscoll, 548 Union St., Brooklyn, $294,000; Ormond & O'Brien, 1133 Broadway, $288,000; T. J. Brady & Co., 1123 Broadway, $262,840; William J. Craford, 1095 Lorimer St., Brooklyn, $306,000; Charles Mead & Co., 299 Broadway, $294,000; Jump & Wellsted, $321,900; Albert Winternitz, 237 East 72d St., $318,000; William Horne Co., 71 West 132d St., $338,000; Charles H. Peckwith, 415 Hudson St., $287,745; J. H. Parker Co., 18 East 69th St., $273,000.

NEW YORK, N. Y.—Bids are asked until 2.30 p. m., Oct. 26, by the Department of Public Charities, for providing all labor and materials, including chambers, cars, formaldehyde retorts, transfer table, tracks, sleepers, tees, valves, piping and all other work necessary to the installation of a combined steam and formaldehyde disinfecting system (except the supplying and installation of a vacuum pump) for the new municipal lodging house, situated east of First Ave. and on the southerly side of 25th St., Borough of Manhattan, City of New York; for providing all labor and materials necessary for the supply, installation and connection at outlets of a complete equipment of gas and electric lighting fixtures, consisting of brackets, clusters, ceiling lights, arc lamps and all other required work, and for the supply and complete installation and connection of cooking apparatus, fixtures and fittings for same; for providing all labor and materials, including vacuum air pumps, motors, separators, receivers, air filters, separate lines of piping, hose, renovators, fittings, fixtures, cases, equipment and all other work necessary for the installation and entire completion of a system of vacuum sweeping for same. Robert W. Hubbard is Comr.

NEW YORK, N. Y.—Bids are asked until 3.30 p. m., Oct. 26, by the Department of Education, for furniture for new public school No. 93, on New York Ave., corner of Herkimer St., Borough of Brooklyn; for installing electric equipment in addition to and alterations in public school No. 132, on the easterly side of Wadsworth Ave., between 182d and 183d Sts., Borough of Manhattan; for furniture for new public school on Washington and Lincoln Aves., near Jamaica Ave., Richmond Hill, Borough of Queens. C. B. J. Snyder is Supt. School Bldgs.

NEW YORK, N. Y.—Plans have been filed for a 12-story apartment house to be built at the corner of Riverside Drive and 85th St., for the Riverside Realty Co., Arlington C. Hall, Pres. The structure will front 102.2 ft. on Riverside Drive and 115 ft. on the street. It will cost $800,000, according to the estimate of Neville & Bagge, Archs., 217 West 125th St.

HADDONFIELD, N. J.—Bids are asked until Oct. 23 by E. T. Gill, Pres., Old Tavern House, East Main St., for remodeling and restoring the "Old Tavern House" building. Brockie & Hastings, of Philadelphia, Pa., are Archs.

PHILADELPHIA, PA.—A plan to erect a settlement house in the southern part of the city has been indorsed by the Philadelphia Baptist Association. The building will cost $75,000. Its cost will be defrayed from a $100,000 bicentennial fund, which is being raised by the Baptist churches and institutions of Philadelphia. Plans for the settlement house will be obtained immediately by the Bicentennial Enterprise Committee. Rev. Dr. J. Henry Haslam, Chn. Doctor Haslam states that the site has not been selected, but that it will be in the southern part of the city east of Broad St.

The Directors of the Philadelphia Cricket Club, whose clubhouse in Germantown was destroyed by fire recently, have commissioned George T. Pierson to prepare plans for a new building to take the place of that structure. No details have been determined as yet, except that it will be of stone, three stories high and will cost about $40,000.

J. E. & A. L. Pennock have posted plans by J. Horace Cook, Arch., for the erection of the William B. Hanna Public School, at 58th and Media Sts., at a cost of about $200,000. It will be three stories, basement and attic in height, and will be constructed of brick and terra cotta. Provision is made for 27 classrooms, a number of offices and other quarters. The dimensions are 180.4 x 88.7.

George Shisler has secured a site bounded by 21st, 23d and McKean Sts. and Snyder Ave., and it is stated he will erect 700 2 and 3-story residences at a total cost of about $2,000,000.

It is stated that A. WHITEHEAD, 1624 Latimer St., has secured the contract to erect a 3-story brick and marble children's ward at the Woman's Hospital.

*ALLENTOWN, PA.—The plans of Ruhe & Lange, Archs., of Allentown, have been accepted for the proposed high school, to cost about $90,000.

HAVERFORD, PA.—Thomas P. Hunter, Pres. Acme Tea Co., 35 South Second St., Philadelphia, has bought six acres of land at Haverford and contemplates erecting a 3-story residence. Cost, over $300,000. Architect has not been selected.

MILLVILLE, PA.—The Millville Board of Education has decided to erect the proposed $48,000 Culver School at Third and Sassafrass Sts.

PHILADELPHIA, PA.—Bids are asked until 11 a. m., Nov. 21, by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for additions to and alterations in the Naval Hospital buildings, Philadelphia. Plans and specifications can be obtained on application to the bureau or to the commandant of the navy yard. William M. Smith, is Acting Ch. of Bureau. Specifications for this work are on file at office of Engineering News, N. Y.

BALTIMORE, MD.—Bids are asked until 11 a. m., Oct. 28, by the Board of Awards for constructing the proposed administration building for Sydenham Municipal Hospital for contagious diseases. Edward D. Preston is Inspector of Bldgs.; J. Barry Mahool is Pres. Bd. of Awards.

WASHINGTON, D. C.—Malcolm W. Hill, of Baltimore, and R. Golden Donaldson, of this city, having purchased a large tract of land near M St. and North Capitol St., are to erect a large warehouse, with a frontage of 275 ft. and a depth of 270 ft., an approximate floor space of 100,000 sq. ft. will be obtained. It will be of fireproof construction, the materials being brick, concrete and iron framework.

WASHINGTON, D. C.—Bids will be received until noon, Oct. 24, by the Superintendent of U. S. Capitol Buildings and Grounds, for furnishing and erecting in the office building U. S. Senate, Washington, three electrically operated dumbwaiters. Specifications for this work are on file at the office of Engineering News, New York.

WASHINGTON, D. C.—A permit has been issued for the 4-story brick building which is to be erected at Twelfth and S Sts., at a cost of $80,000 for the Colored Men's Branch of the Y. M. C. A. J. L. MARSHALL, 614 13th St., N. W., has the contract. W. S. Pittman, 494 Louisiana Ave., N. W., Arch.

NATIONAL SOLDIERS' HOME, VA.—Bids are asked until Nov. 5 by John T. Hume, Treas., Southern Branch, N. H. D. V., National Soldiers' Home, for furnishing material and constructing steel ceilings in governor's quarters and barracks. Companies I, K and L, and for installing intercommunicating telephone system in hospital Building No. 39, furnishing and installing metal drying rooms in main laundry (Building No. 13), and hospital laundry (Building No. 19).

RALEIGH, N. C.—The North Carolina State Hospital Commission has awarded contracts for erecting 10 buildings in connection with the State Hospital here to D. GRANDY, of Charlotte, and to J. F. ONGE, the contract to erect four additional buildings, at the Colored Hospital at Goldsboro. It is reported that the total cost of the buildings will be about $125,000.

NEWBERN, N. C.—Bids will be received until 3 p. m., Nov. 11, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the extension, remodeling, etc., of the U. S. postoffice, courthouse and custom house building at Newbern.

GREENSBORO, GA.—The contract for the superstructure of the First Methodist Church, which is to be of brick and stone, will be let about Dec. 1. Estimated cost, $50,000.

BIRMINGHAM, ALA. — The contract to erect the Chamber of Commerce Building, was awarded on Oct. 10 to T. C. THOMPSON, Title Guarantee Bldg., The total cost of the building will be $150,000.

MOBILE, ALA.—JETT BROS. CONTRACTING CO., of Mobile, are reported to have secured the contract for erecting a 4-story brick warehouse at Commerce and St. Louis Sts., for Martin Lindsay, of Pollard. Estimated cost, $30,000. Stone Bros., are Archs.

E. E. WARD & CO., 204 South Broad St., have secured the contract to erect the hotel at St. Joseph and Beauregard Sts. for J. B. Webster.

UNIVERSITY, ALA.—Bids are asked by John W. Abercrombie, Pres. University of Alabama, until Oct. 24, for furnishing engineering laboratory and power plant equipment for engineering building and also for furnishing materials and constructing a central heating system. Detail specifications and bidding sheets can be obtained on application and plans inspected at the office of the president.

YOUNGSTOWN, OHIO.—Owsley & Boucherle, Wick Bldg., Youngstown, Archs., have completed plans and specifications for a 3-story brick block to be erected for Scott & Jones adjoining the Pabst Building on West Federal St. The building will be of brick and stone construction with white enamelled front.

TOLEDO, OHIO.—Bids are asked by James Knox Taylor, Superv. Arch., Washington, D. C., until 3 p. m., Nov. 10, for the construction of the U. S. post-office at Toledo, in accordance with the drawings and specification, copies of which may be obtained from the custodian of the site at Toledo.

MARIETTA, OHIO.—Bids were received as follows on Oct. 15, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of the proposed public building at Marietta: H. F. Holden, of New York, $78,400; McHenry, Beatty & Co., of East Liverpool, Ohio, $81,449, the Bedford Stone Co., of Indianapolis, $93,700; James Devault, of Canton, $91,654.

COLUMBUS, OHIO.—The Tracy-Wells Co., Spring & Front Sts., will erect a 6-story brick building, to cost $200,000.

ADRIAN, MICH.—A $200,000 office building will be erected in this city by the Adrian Building & Improvement Co. It will be five stories high, and located at the corner of Maumee and Broad Sts. J. I. Day, of New York, is Pres., and R. C. Sturgeon, of Detroit, is Treas.

LAKE FOREST, ILL.—Finley, Barrell, Marquette Bldg., Chicago, is having plans prepared for a residence to be erected at Lake Forest at a cost of $50,000.

PEORIA, ILL.—The WESTLAKE CONSTRUCTION CO., of St. Louis, Mo., is stated to have secured the contract for erecting a bank building for the Jefferson Deposit Co. for $500,000.

CHICAGO, ILL.—The White City Amusement Co. has in view the construction of another large building adjacent to its amusement park at 63d St. and South Park Ave. The company has acquired the site. The building will be of frame and stucco, and the cost is estimated at $200,000.

Beers & Beers, Orchestra Bldg., are preparing plans for a 3-story administration building to be erected at Indiana Ave. and 50th St., for Chicago Refuge for Girls. Other buildings are to be erected, replacing the present structures of the institution. Estimated cost, $200,000.

The general office and freight terminal building to be erected by the Chicago & Alton R. R. Co. it is reported, is to be built at 2 West Van Buren St. and cost about $200,000. W. D. Taylor, Railway Exchange Bldg., is Ch. Engr.

Thomas McCall is preparing plans for a 3-story apartment house, 115 x 120 ft., to be erected for John W. Coutts of River Forest on Madison Ave., between 60th and 61st Sts. It will be divided into 18 apartments of four and five rooms and will cost $50,000.

The same architect is preparing plans for Wills & Smith for a 3-story apartment house 100 x 150 ft., to be erected at the corner of South Park Ave. and 58th St. It will be divided into 24 apartments of four, five and six rooms, and will cost $70,000.

CHICAGO, ILL.—D. H. Perkins, Arch. of the Chicago Board of Education, has awarded the RAYMOND CONCRETE PILE CO. of New York and Chicago, the contract for placing concrete piles in the foundations of the Bowen School at South Chicago.

OCONOMOWOC, WIS.—Plans have been completed for a $40,000 clubhouse for the Oconomowoc Lake Club. P. A. Valentine, of Chicago, Ill., is interested.

MENDOTA, WIS.—Bids will be received by M. J. Tappin, Secy., State Bd. of Control, until Nov. 3 for the enlarging of a steel tank at the State Hospital, Mendota. Plans and specifications and blank proposals may be had from W. G. Kirchoffer, Engr., Madison, Wis.

DULUTH, MINN.—The Commercial Club is having plans prepared by Bray & Nystrom, of Duluth, for a $100,000 building. H. V. Eva is Secy.

MINNEAPOLIS, MINN.—It is stated that the Northern Theatrical Co. has decided to erect a theater in Minneapolis. Estimated cost, $150,000.

IOLA, KAN.—Bids will be received at the office of James Knox Taylor, Superv. Arch., Washington, D. C., until 3 p. m., Nov. 16, for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the U. S. post-office at Iola, in accordance with the drawings and specifications, copies of which may be had from the custodian of the site at Iola, or at the office of the supervising architect.

WASHBURN, N. DAK.—Bids are asked until Nov. 9 by O. B. Wing, County Audr., Washburn, for steam heating and plumbing in the new county office building at Washburn. Hancock Bros., of Fargo, N. Dak., are Archs.

RAWLINS, WYO.—Bids are asked at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., Nov. 19 for the construction complete of U. S. post-office at Rawlins.

ST. LOUIS MO.—Thomas C. Young, Eighth and Pine Sts., has been selected to prepare plans for the Nurses' Training School, to be erected at the City Hospital, at a cost of $80,000.

The Mullanphy Emigrant Aid Society has applied for a permit to erect a 3-story tenement at 21st and Mullanphy Sts. at an estimated cost of $69,000. Barnette, Haynes & Barnett, Olive and Ninth Sts., St. Louis, are Archs.

LITTLE ROCK, ARK.—A plot of ground in the rear of the Hotel Marion, in this city, has been purchased by Herman Kahn, of the Marion Hotel Co., and plans are under way for the erection of an annex to the hotel at a cost of $165,000.

FORT SMITH, ARK.—It is reported that a 10-story office building is to be erected at Garrison Ave., and Sixth St., at a cost of $450,000. W. W. Bailey and the heirs of the late George Sparks are interested.

HOUSTON, TEX.—The Houston Chronicle Bldg. Co. has awarded the contract for the 10-story brick office building 72 x 125 ft., to be erected at Travis St. and Texas Ave., to SELDEN-BRECK CONSTRUCTION CO., of St. Louis, Mo., for about $300,000. Mauran, Russell & Garden, of St. Louis, Mo., are Archs.

LANGSTON, OKLA.—The Board of Regents of the Colored Agricultural and Normal University at Langston, it is reported, have authorized the secretary to ask bids for the erection of a main building at the university, to replace structure destroyed by fire. Estimated cost, $80,000.

PUEBLO, COLO.—K. E. McMillan, it is stated, intends erecting a fireproof warehouse in the wholesale district. The building will cost about $40,000.

SEATTLE, WASH.—A. J. Jarmuth is preparing to erect a block of eight residences from 2901 to 2915 Franklin Ave. in the Denny-Fuhrman Addition. The block will be a single structure, but each building will be completely cut off from the others, having full basement and a backyard the width of the house. One heating plant will supply the block. The material [illegible] will be concrete and the cost will [illegible] 40,000. C. A. Reinoehl, Arch., has pre[illegible] the plans for the building.

The following bids were [illegible]ved Oct. 5 by the State Commission to [illegible] Alaska-Yukon-Pacific Exposition for er[illegible] the Forestry building: Burwell Bridge [illegible]struction Co., $68,440; H. Chase & Co., [illegible] P. E. Dunnavant & Co., $66,973; [illegible]w, Freeze & Paterson, $68,975, and La[illegible] Peters, Inc., $54,900.

SPOKANE, WASH.—An [illegible]ory fireproof hotel is to be built here [illegible] occupy the block bounded by Spragu[illegible] First Aves., Post and Lincoln Sts., ex[illegible] L. M. Davenport's property. The b[illegible] will be of steel-concrete constructio[illegible] will cost about $1,000,000. K. K. [illegible] of Cutter & Malmgren, is Arch.

TACOMA, WASH.—CHA[illegible] SAYRE has secured the contract for [illegible]ions to the public library on Tacoma [illegible]

*BAKER CITY, ORE.—Bi[illegible] be received until Nov. 24 by James Kn[illegible]lor, Superv. Arch., Treasury Dept., W[illegible]gton, D. C., for the construction (compl[illegible] of the U. S. post-office at Baker City.

LOS ANGELES, CAL.—The [illegible]dental Life Insurance Co., proposes to [illegible] a building at the corner of Seventh and [illegible]e Sts. The lot has a frontage of 105 [illegible] on Seventh St. and 112 ft. on Olive St. [illegible]mated cost, $800,000.

BERKELEY, CAL.—Ground [illegible] be broken within a short time for the Bo[illegible] law library of the University of California [illegible] be erected at a cost of $250,000. Announcement to this effect has been made by George H. Boke. The necessary funds for the erection of the law library are available and it is expected to complete the building by August, 1909.

SALT LAKE CITY, UTAH.—Upon the recommendation of Richard Kletting, Arch., the Board of Education, has awarded the contract for the 2-story, 18-room school building to be erected upon the Walker site, to the VANDER HORST BROS. Vander Horst Bros. offered two bids, one on the regular plan for $75,000, and the other on the alternate plan for $71,000. The latter was accepted. There were three other bidders: Fred. Dryer, Lester & Dean and J. W. A. Timms & Son. The WILL REESE PLUMBING CO. has been awarded the contract for the heating and plumbing for $9,200 and $4,865, respectively. THE INTERMOUNTAIN ELECTRIC CO. has the contract for the wiring for lights for $734.

OGDEN, UTAH.—Bids will be received about Nov. 15 for the erection of the proposed high school, from plans of Smith & Hodgson, 312 Eccles Bldg., Ogden. Estimated cost, $100,000. Ivy Williams is Clk. Bd. Education.

QUEBEC, QUE.—Bids will be received by Nap Tessier, Dept. Pub. Works, Ottawa, Ont., until 3.30 p. m., Oct. 27, for the construction of a drill hall for the School of Gunnery here. Plans and specifications may be seen at the department; also at the offices of the resident engineers here and at Montreal, Que.

TORONTO, ONT.—It is reported that plans are being prepared for an 8-story hotel to be erected on the site of the present British Hotel at King and Simcoe Sts. and to cost about $150,000. Lawrence Solman is owner.

WATER SUPPLY—IRRIGATION.

(* *denotes that this work is advertised in Engineering News.*)

EASTHAMPTON, MASS.—The citizens are Oct. 9 voted to accept the report of the Water Commission, F. W. Pitcher, Chn., for an additional water supply. Estimated cost, about $32,000.

PLAINVILLE, CONN.—The Plainville Water Co. will lay a new 12-in. main from its reservoir, through Mountain View, into the center of the town.

FORT SLOCUM, N. Y.—Bids are asked until 11 a. m., Nov. 7, by Capt. Peter Murray, Constructing Q. M., U. S. A., for furnishing all labor and material necessary for extending the water main at this post, consisting of approximately 600 ft. of 4-in. c.-i. water main, two fire hydrants and one 4-in. gate valve and valve box. Plans for this work may be seen at the office of the Constructing Quartermaster, where specifications, proposal blanks and all necessary information may be obtained on application. Bidders should examine site before submitting bids. (Fort Slocum—New Rochelle, N. Y., post-office.)

*KINGS PARK, N. Y.—The bids received by the State Commission in Lunacy, Albany, on Oct. 14, for constructing an extension to the water supply system of the Kings Park State Hospital at Kings Park, N. Y., were as follows: Commercial Construction Co., 114 East 28th St., New York, $9,500; Hudson Engineering Co., 90 West St., New York, $10,500; P. H. & J. Conlan, Newark, N. J., $12,975. F. B. Ware is State Arch.

COHOES, N. Y.—Plans, specifications, with approximate estimate of cost are asked by the Board of Water Commissioners until Nov. 2, for the construction of a mechanical filter plant for the city. Plans must be on file at the office of the Water Commissioners on or before the above-mentioned date. H. L. Shaver is Pres.

READING, PA.—The contract for Portland cement for slow sand filters for the Madison Creek water supply, bids opened on Oct. 6 by the Water Commissioners, Harry K. Brown, Asst. Supt., has been awarded to H. E. AHRENS CO., of Reading, for 18,000 bbls. of Lehigh Portland cement at $20,880.

ERIE, PA.—The Water Commissioners, G. C. Gensheimer, Secy., are preparing preliminary plans and specifications for a 20,000,000-gallon vertical triple-expansion self-contained pumping engine.

FALLS MILLS, W. VA.—The Norfolk & Western Ry. Co., C. S. Churchill, Ch. Engr., Roanoke, Va., may construct a dam and reserve reservoir at Falls Mills. Estimated cost, $18,000.

PARKERSBURG, W. VA.—Chapin & Knowles, Frick Bldg., Pittsburg, Pa., are preparing plans for water-works for Parkersburg. Frank Good is City Audr. C. D. F[illegible] is Secy. Water Comrs.

LENOIR, N. C.—The city has awarded the contracts for constructing water-works and sewerage systems as follows: To GUILD & CO., Chattanooga, Tenn., for 500,000-gallon reservoir; to PIEDMONT CONSTRUCTION CO., Atlanta, Ga.; for valves and hydrants, FAIRBANKS CO., Light and Lombard Sts., Baltimore, Md.; for piping, DIMMICK PIPE CO., Birmingham, Ala. J. B. McCrary & Co., Atlanta, Ga., are Engrs.-in-Charge. The water will be supplied by gravity from a point about five miles from Lenoir. The intake is about 577 ft. above the town, and city has purchased 200 acres as a watershed located in the Green Mountains. J. C. Seagle is Secy.-Treas.

COVINGTON, GA.—Bids will be received until Oct. 27 by the city for the construction of water-works and a sewerage system here. Estimated cost, $60,000. W. T. Miener is City Clk.

AUGUSTA, GA.—Bids will probably soon be asked by the Commissioner of Public Works for the construction of an auxiliary pumping station.

DOUGLAS, GA.—The citizens on Oct. 3 voted to issue $35,000 bonds for improvements to water-works, electric light plant and schools. W. W. Southerland is City Clk.

*GADSDEN, ALA.—Bids are asked by the City Council until noon, Nov. 12, for water-works extensions and improvements. Hazelhurst & Anderson are Engrs.

JACKSON, MISS.—The city has awarded the following contracts for the construction of a water-works system: O. O'HERRON & CO., Pittsburg, Pa., at $25,820, for laying about 20 miles of c.-i. water mains; RENSSELAER MFG. CO., Troy, N. Y., at $7,080, for fire hydrants, and at $3,493 for gate valves; MISSISSIPPI FOUNDRY & MACHINE CO., of Jackson, for valve boxes. Hamilton Johnson is City Engr.

VERSAILLES, KY.—The City Council has retained Charles E. Collins, Drexel Bldg., Philadelphia, Pa., as engineer on the construction of a system of water-works, including pumping plant and reservoir. The contract for construction has been awarded to the SHEFOLD CO., New Albany, Ind.

CINCINNATI, OHIO.—Bids will be received until noon, Oct. 29, by the Board of Public Service, J. J. Wenner, Clk., for cleaning c.-i. pipe and special castings and valves, etc., for the Water Department.

TOLEDO, OHIO.—Bids will be received until Nov. 12 by the Board of Public Service, Reynold Voit, Secy., for furnishing material and constructing a brick, concrete and steel pumping station together with coal storage and pump well, being Contract No. 11 of the improvement of water supply. Bids on labor and material must be submitted separately.

WABASH, IND.—The Wabash Water & Light Co. contemplates expending $50,000 for improving the equipment of the water and light plant. T. W. McNamee is Supt.

*EVANSVILLE, IND.—We are officially advised that bids were received as follows on Oct. 12 by the Water Department for the construction of a mechanical filtration plant: New York Continental Jewell Filtration Co., 15 Broad St., New York, three bids, $262,000, $248,000 and $227,000; Norwood Engineering Co., Florence, Mass., $245,000; Thomas Lightbody, Youngstown, Ohio, $270,000 and $220,000. John W. Alvord, Hartford Bldg., Chicago, Ill., is Engr.

BELOIT, WIS.—Bids are asked by the Board of Public Works until 10 a. m., Oct. 26, for laying water laterals in several streets.

*BURLINGTON, IOWA.—Bids were opened on Oct. 6 by the Joint Board of Supervisors of Louisa and Des Moines Counties at the office of the Auditor of Des Moines County at Burlington for furnishing and erecting as a part of the Louisa-Des Moines Drainage Dist. No. 4 of said counties a pumping plant comprising a 300-HP. water tube steam boiler, a 500-HP. horizontal compound condensing steam engine, two 45-in. centrifugal pumps, together with all foundation buildings, appurtenances, piping, etc., for completing the plant as follows: A. M. Lockett & Co., New Orleans, La., parts 1 and 2 combined, $28,701; for installation of one 60-in. pump instead of two 45-in. pumps, as specified, $25,530; Arbuckle, Ryan & Co., Toledo, Ohio, part 1, $8,183; part 2, $22,792; for combined parts with 48-in. pumps, $29,000; with 45-in. pumps, $28,500; Erie City Iron Works, Chicago, Ill., part 1, $6,520; part 2, $19,200, with 48-in. pumps. Harman Engineering Co., of Peoria, Ill., are Engrs.

SAINT MARYS, KAN.—Bids will be received until Nov. 10 by the city for the construction of a water-works system. Estimated cost, about $47,000. Burns & McDonnell, Scarritt Bldg., Kansas City, Mo., are Engrs.

FARGO, N. DAK.—Bids will be received until Oct. 23 by N. C. Morgan, City Audr., for furnishing material and constructing a 6-in. water main in a portion of Oak St.

MURDO, S. DAK.—Bids will be received early next month for a partial system of water-works, to include the installation of a deep well pumping engine, which will be furnished by the city, the building of a pump house with derrick tower, and the conducting of a 4-day pumping test on the well after completion of this work. Bids will be received on the furnishing and installing of a 15-HP. gasoline engine, laying 2,620 lin. ft. 6 in. c.-i. mains and appurtenances, and the erection of a 50,000-gallon elevated tank. Plans are on file at the office of the Dakota Engineering Co., Mitchell, S. Dak.

KANSAS CITY, MO.—The contract for 600 tons of c.-i. pipe and 50 tons of specials, bids opened on Oct. 8, has been awarded by the city to U. S. PIPE CO., of Chicago, Ill., at about $15,000.

*KANSAS CITY, MO.—Bids will be received by the Board of Fire and Water Commissioners at the office of the Board, City Hall, Kansas City, until 2 p. m., Nov. 9, for the construction of a settling basin at Quindaro, Kan., the present settling basins at Quindaro, Kan., of either 45,000,000 or 50,000,000-gallons' capacity, depending upon the type of construction finally decided on. A wholly independent proposal is requested upon each of the two types of construction, one type embracing earthen embankments capped with a light wash wall, the other type embracing an earthen embankment faced with a reinforced-concrete retaining wall with counterforts. All proposals shall be based upon and shall be in accordance with the approximate estimate of quantities and the plans and specifications approved by the Board of Fire and Water Commissioners and on file in the office of the Board. J. L. Darnell is City Engr.

HOPE, ARK. — We are officially advised that bids were opened on Oct. 6 as follows by the Board of Water-Works Improvements for furnishing material and constructing a system of water-works, consisting of a surface reservoir about 70 × 35 × 12 ft. of reinforced concrete and about 900 tons of c.-i. pipe, together with hydrants, valves, etc.: Irwin Bros., New Orleans, La., $71,238; Hamilton Bros. Construction Co., Taylorville, Ill., $61,684; R. C. Huston, New Orleans, $64,793; W. W. Cook & Son, Junction City, Kan., $61,175; Newman Construction Co., Evansville, Ind., $69,548; Bosler & Flynn, Chattanooga, Tenn., (partial bid, on reservoir and pipes and specials), $25,494; Materns Mfg. Co., St. Louis, Mo., $69,530; BOSH & GRAY, Joplin, Mo., $58,828 (awarded contract); T. H. Inglehart, **Morgan Park,** Ill., $60,221; Fred Wilson, Pine Bluff, Ark., (partial bid, on reservoir), $3,457; Zeb Ward, Little Rock, Ark., $69,549; J. J. Dunegan, Shenandoah, Iowa, $65,397; Nick Peay, Little Rock, $59,697; Bourbon Copper & Brass Works Co., Cincinnati, Ohio, (partial bid, on valves), $2,778; Standard Construction Co., Chicago, Ill., $61,787; Coffin Valve Co., Boston, Mass., (partial bid, on valves), $3,145. J. A. Hanberg, Jr., is Consulting Engr., Goodwyn Bldg., Memphis, Tenn.

GREENVILLE, TEX.—Bids will be received until Nov. 3 by Joseph F. Nichols, Mayor, for graduation of an earth embankment reservoir containing 90,000 cu. yds. Maxcy & Horton are Engrs., Houston, Tex.

BURLINGTON, COLO.—We are officially advised that the DES MOINES BRIDGE & IRON CO., of Des Moines, Iowa, was awarded the contract on Oct. 12 by the Water-Works Committee for the construction of water-works here.

FORT GEORGE WRIGHT, WASH.—Bids will be received until Nov. 2 by Lieut. Ralph Dickinson, Q. M., Fort George Wright, for furnishing 14 fire hydrants at this post.

ASTORIA, ORE.—Goodin & Mattson, of Astoria, submitted the lowest bid on Oct. 2 to the Astoria Water Commission for the construction of a 20,000,000-gallon reinforced-concrete reservoir at $104,357.

WELLTON, ARIZ.—The Antelope Valley Irrigation Co. has been incorporated, with a capital of $750,000, to distribute water over the entire section of the valley south of the Gila River. The incorporators are: W. E. Proebstel, E. L. Edmundson and others.

CALDWELL, IDAHO.—The contract was let on Oct. 2 by the Murphy, Lang & Irrigation Co. to HARVEY L. HOLLOWAY, of Boise, Idaho, for the construction of the dam for the reservoir in Sinker Creek canyon from which the project will be watered. The retaining dam will be constructed 67 ft. high this winter, work being commenced immediately and pushed toward completion before the irrigation season next spring. The dam will be 117 ft. high when completed.

ORILLIA, ONT.—The citizens voted on Oct. 5 to issue $10,000 of bonds for extensions to the water-works.

HAMILTON, ONT.—The Fire and Water Committee on Oct. 8 opened bids for pumps and motors for the water-works. The lowest bids were as follows: For the pumps, McDougal Co., of Montreal, Que., at $7,220; The Westinghouse Co., for motors, at $9,570; J. Montgomery, of Toronto, for installing a compressed air system for pumping water to the mountain top, at $6,500.

SEWERAGE.

(denotes that this work is advertised in Engineering News.)*

PORTSMOUTH, N. H.—SMALL & INGALLS, of Bar Harbor, Me., were awarded the contract on Oct. 7 by the City Council for constructing a sewer in Richards and Parrott Aves. at $6,716. Other bidders were: F. Lizio, Portsmouth, $12,295; J. Sacco & Co., Portsmouth, $8,690; Ryan & Umback, Boston, Mass., $8,725; Joseph R. Holmes, Portsmouth, $8,710; L. E. Scruton, Rochester, $10,000.

HARTFORD, CONN.—Bids for the construction of about 700 lin. ft. of 12-in. sewer in Vine St., will be received by the Board of Contract and Supply, James P. Berry Secy., until 11 a. m., Oct. 26.

SYRACUSE, N. Y.—The proposed intercepting sewer will cost about $200,000 and will be of brick and cement. Bids for the bonds will be called for about Jan. 1 and for the construction a little later. Glenn D. Holmes is Ch. Engr., 112 Court House.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Oct. 29, by Louis F. Haffen, Pres. Boro. of the Bronx, for constructing sewers and appurtenances in various streets.

FAIRPORT, N. Y.—Bids will be received until Oct. 24 by R. L. Williams, Village Clk., for constructing a sewer in Frank St.

PATERSON, N. J.—The Finance Committee has accepted the report of the Special Committee on Sewage Disposal recommending that the city enter into a contract with other municipalities of the Passaic Valley Sewerage District and with the Passaic Valley Sewerage Commissioners, with the stipulation that the city may withdraw if the cost of the proposed trunk sewer exceeds the estimate of $12,250,000.

MILTON, PA.—Plans are being prepared by Alexander Potter, Consulting Engr., 143 Liberty St., New York, for the construction of a sewerage disposal plant.

BEAUFORT, N. C.—The Town Commissioners have authorized the issuance of $20,000 of bonds for drainage. C. S. Maxwell is Clk.

LENOIR, N. C.—The city has awarded the contract to GUILD & CO., Chattanooga, Tenn., for constructing sewer and water systems at about $60,000. J. B. McCrary & Co., Atlanta, Ga., are Engrs.

COVINGTON, GA.—See item under Water Supply—Irrigation.

BIRMINGHAM, ALA.—C. M. BURKHALTER, of Birmingham, has been awarded the contract by the city at $23,035 for constructing vitrified-brick sanitary sewers. Julian Kendrick is Engr.

JACKSON, MISS.—The city has awarded the contract to O. O'HERRON & CO., Pittsburg, Pa., for constructing a sewer system complete, including nine miles of vitrified-clay sewer pipe, at $36,500. Hamilton Johnson is City Engr.

VERSAILLES, KY.—We are officially advised that the City Council has engaged Charles E. Collins, Consulting Engr., Drexel Bldg., Philadelphia, Pa., to take charge of the engineering work on the construction of a complete system of sanitary sewers and sewage disposal works; also a system of water-works including pumping plant and reservoir. Contracts have been awarded for the construction to the SHEFOLD CO., New Albany, Ind.

*LOUISVILLE, KY.—We are officially advised that bids were received as follows on Oct. 16 by the Commissioners of Sewerage for the construction of the Breckenridge St. sewer, Contract No. 13, of the comprehensive system of sewerage, the work consisting mainly of constructing a sewer of concrete as follows: 1,223 ft., 54-in. diameter; 48 ft., 51-in. diameter; 484 ft., 45-in. diameter; the average depth of cut, 13.4 ft.; approximately 740 cu. yds. of concrete: HENRY BICKEL CO., Louisville, $12,010 (awarded contract); Paul & Kirshner, Dayton, Ohio, $12,264; Scholtz & Vogt, Louisville, $13,598; Coupe & Gray, Louisville, $16,340; Cement Block & Roofing Co., Kenton, Ohio, $16,722. J. B. F. Breed is City Engr.

CLEVELAND, OHIO.—Bids are asked by the Board of Public Service until noon, Oct. 29 for the construction of sewers in various streets. W. J. Springborn is Pres. Bd.

MARYSVILLE, OHIO.—J. C. Kennedy, of Marysville, has been instructed to prepare plans and specifications for and estimate the cost of a sanitary sewerage system here.

COLUMBUS, OHIO.—Bids will soon be asked by the city for the construction of a relief sewer in Scott St., parallel to the Pennsylvania R. R. tracks. Estimated cost, $20,000.

DAYTON, OHIO.—Plans are being prepared for the construction of a storm water intercepting sewer in North Dayton. Estimated cost, $18,000.

AKRON, OHIO.—The Council has passed an ordinance providing for the issuance of $6,100 of bonds for the construction of sewers in West Thornton and Mayfield Sts.

JEFFERSON, OHIO.—All bids opened on Oct. 12 for constructing a sewer and sewage disposal plant for the county buildings have been rejected. The work will probably go over until next spring. P. C. Remick is County Audr.

WABASH, IND.—We are officially advised that THOMAS McGARVEN, of Wabash, was awarded the contract by the city on Oct. 12 for the construction of a sewer in North Welter St. from Miami to Cass Sts. Fremont McLees is City Clk.

ELKHART, IND.—The Board of Public Works will soon ask for bids for the construction of two sewers, one in Madison St. and one in Johnson's Riverside addition. The HUDSON STIRLING CO. has been awarded a contract for the construction of a sewer in the factory district.

LANSING, MICH.—Plans are being prepared by the City Engineer for the construction of about 3,000 ft. of sewer in Ionia Lahoma, Michagan and Huron Sts.

TRENTON, MICH.—Plans have been completed by Mason L. Brown, Engr., for the construction of a sewer system here. Estimated cost, about $15,000.

AURORA, ILL.—The City Engineer will soon begin work on plans for the construction of sewers for that section of the city east of Jackson St. and south of Second Ave. Estimated cost, $40,000.

SPRINGFIELD, ILL.—Plans are being prepared by F. H. Hamilton, City Engr., for constructing a sewer from Sixth St. to Maple and Fourth Sts., to include 2,000 ft. of single ring vitrified brick sewer, 4-in. diameter.

QUINCY, ILL.—The City Engineer has estimated the cost of constructing the North End sanitary sewer at $53,997.

CHICAGO ILL.—John W. Farley submitted the lowest bid on Oct. 15 to the Board of Local Improvements for the construction of the Western Ave. sewer at $427,608.

DE PERE, WIS.—Bids are asked until 4 p. m., Oct. 24, by the City Clerk for digging and laying a 27-in. pipe or 30-in brick sewer in a portion of Charles St.

BELOIT, WIS.—Bids are asked until 10 a. m., Oct. 26, by the Board of Public Works for laying sewer laterals in certain streets.

OCONOMOWOC, WIS.—E. B. Parsons, Engr., Watertown, Wis., has prepared plans for the construction of a sewerage system in Main, Milwaukee, South and Worthington Sts.

COUNCIL BLUFFS, IOWA.—Bids are asked until noon, Oct. 26, by A. W. Casady, City Clk., for the construction of sewers in certain streets.

DULUTH, MINN.—The city contemplates constructing sanitary sewers this fall. Estimated cost, $25,000. R. Murchison is Clk. Bd. Pub. Wks.

SALINA, KAN.—J. M. CHEIN & CO., of Wichita, Kan., were awarded contracts on Oct. 5 by the Council for the construction of about 1⅓ miles of sewers here at $6,654.

OMAHA, NEB.—Bids will be received until Oct. 26 by the City Engineer for constructing sewers in sewer district Nos. 370 and 371. Dan C. Butler is City Clk.

CARTERVILLE, MO.—Plans are being prepared by Frank Funk, Engr., for the construction of five district vitrified pipe sewers here. H. E. Moody is City Clk.

JOPLIN, MO.—Plans are being prepared by Burns & McDonnell, Consulting Engrs., 821-823 Scarritt Bldg., Kansas City, Mo., for the construction of a brick storm and sanitary sewer. Cost, $96,000. Hiram Phillips, City Clk.

POPLAR BLUFFS, MO.—Plans are being prepared by E. C. Nickey, City Engr., for fourteen blocks of vitrified pipe sewers here. N. A. Spence is City Clk.

HOPE, ARK.—We are officially advised that bids were received as follows on Oct. 6 by the Board of Sewer Commissioners, Improvement District No. 1, for furnishing material and constructing a system of sanitary sewers: Newman Sewer Construction Co., Evansville, Ind., $69,930; J. J. Dunegan, Shenandoah, Iowa, $69,782; G. Munz, Texarkana, Tex., $65,454; Standard Construction Co., Chicago, Ill., $86,999; Geisel Construction Co., St. Louis, Mo., $72,911; W. T. Riley Construction Co., St. Louis, Mo., $84,074; Pouncey Kaumer & Construction Co., Helena, Ark., $70,145; Monahan Bros., Joliet, Ill., $77,575; Charles F. Derr, Oklahoma City, Okla., $73,756; H. C. Gass, Belleville, Ill., $78,839; Bosler & Flynn, Chattanooga, Tenn., $76,561; Bosh & Gray, Joplin, Mo., $65,249; Nick Peay, Little Rock, Ark., $76,764 (not including excavation); Irwin Bros., New Orleans, La., $81,784; Northern Alabama Construction Co., Riverton, Ala., $81,532; T. M. Bermor, Marion, Ind., $83,584; HAMILTON BROS. CONSTRUCTION CO., Taylorville, Ill., $62,111 (awarded contract); W. W. Cook & Sons, Junction City, Kan., $68,299. J. A. Ornberg, Jr., Godwyn Bldg., Memphis, Tenn., is Engr.

SAN ANTONIO, TEX.—Plans have been prepared by J. E. Van Riper, Asst. City Engr., for the construction of the Prospect Hill sewer system, for which $45,000 of bonds have been voted.

HUBBARD, TEX.—The city has decided to construct a sanitary sewer system.

LONGVIEW, TEX.—E. M. Thomas, President, and James M. Walker, Secy.-Treas. of the Ennis Sewer Co., Ennis, Tex., have engaged N. Werenskiold, C. E., Dallas, Tex., to prepare plans, etc., for the construction of a complete system of sewerage, with disposal plant here, for which the company has secured a 50-year franchise. Work will begin as soon as plans are prepared, about Jan. 1. John W. Fulwider, Lebanon, Ind., will probably be Engr.-in-Charge. Estimated cost, between $30,000 and $35,000.

MARSHFIELD, ORE.—Plans and specifications for a sewerage system covering the entire city have been completed by the City Engineer, the sections to be built as required.

POINT RICHMOND, CAL.—Sewer contracts were awarded as follows on Oct. 5 by the city: G. W. CUSHING, of San Francisco, Cal., sewer in Fourth St., at $20,879; H. B. KINNEY, Chanslor Ave. sewer, $9,800; M. MURPHY, of Berkeley, 23d St. sewer, $7,381.

SALT LAKE CITY, UTAH.—We are officially advised that bids were opened by the Board of Public Works on Oct. 9 for the construction of sewer extension No. 199 as follows: Davis & Heuser, Salt Lake City, $37,835; J. D. Hanley, Salt Lake City, $38,560; JAMES KENNEDY CONSTRUCTION CO., Salt Lake City, $31,211 (awarded contract). L. C. Kelsey is City Engr.

SALT LAKE CITY, UTAH.—We are officially advised that bids were opened as follows on Oct. 9 by the Board of Public Works for the construction of sewer extension No. 203: V. P. STRANGE, Salt Lake City, $12,774 (awarded contract); Davis & Heuser, Salt Lake City, $15,771; J. D. Hanley, Salt Lake City, $14,041; Jas. Kennedy Con. Co., Salt Lake City, $17,687. L. C. Kelsey is City Engr.

GARBAGE DISPOSAL.

(denotes that this work is advertised in Engineering News.)*

WEST HARTFORD, CONN.—The Selectmen of the town have authorized the purchase of a steam roller and sprinkling cart. An appropriation has been made for the purpose.

NEW YORK, N. Y.—Bids were received as follows on Oct. 13 by the Department of Street Cleaning for furnishing all the labor and materials required for the final disposition of garbage, Borough of the Bronx, New York City: The McKeever Co., 347 Meeker Ave., first year $60,000; second year, $65,000; third year, $50,000; N. Y. Sanitary Utilization Co., 130 Burling Slip, $48,500, $53,300, $39,000. Foster Crowell is Comr.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

HARTFORD, CONN.—The contracts for the construction of state road work, bids for which were opened on Oct. 5, have been awarded by the State Highway Commissioner as follows: Town of Columbia, 8,300 lin. ft. grading and telford, on the main road to Willimantic, to AHERN BROS., Putnam, Conn., at 68 cts. per lin. ft. for grading and 87 cts. per lin. ft. for telford; 1,740 lin. ft. gravel on the Tolland road to ANTONIO VITO, Thompson, Conn., at $3,445; 575 lin. ft. gravel-telford on the Columbia Green road to same.

WEST HARTFORD, CONN.—The sum of $15,000 has been appropriated by the town to macadamize Farmington Ave. from Prospect Ave. to Whiting St., a portion of Concord St. and Levesque Ave.

HARTFORD, CONN.—Bids for the construction of 12,865 lin. ft. of graded road, including five 20-in. and one 24-in. tile culverts in the town of Eastford, will be received at the office of the State Highway Commissioner, Capitol, Hartford, until 2 p. m., Oct. 26.

BROOKLYN, N. Y.—Bids are asked until 11 a. m., Nov. 4, by Bird S. Coler, Boro. Pres., for regulating, grading and curbing certain streets; also for laying sidewalks on various streets, and for regulating, paving with asphalt pavement, Class "B," on a concrete foundation the roadway of 61st St., from Fourth Ave. to Fifth Ave., together with all work incidental thereto.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Oct. 29, by the Park Board, for furnishing and delivering Texas road oil (No. 1, 1908), for parks, Borough of the Bronx; for furnishing and delivering 10,000 gals. crude petroleum oil (No. 1, 1908) for parks, Borough of the Bronx. Henry Smith is Pres. Bd.

Bids are asked by the Park Board until 3 p. m., Nov. 5, for furnishing and delivering Hudson River road gravel on Ocean Parkway, Borough of Brooklyn; for furnishing and delivering 2,000 cu. yds. of topsoil or garden mould to Kings Park, Jamaica.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Nov. 2, by John F. Ahearn, Pres. Boro. of Manhattan, for regulating and repaving with asphalt block, sheet asphalt, wood block and granite block on a concrete foundation the roadways of various streets, and for constructing sidewalks on various streets in the Borough of Manhattan.

TROY, N. Y.—The contract for furnishing material, regulating and grading Ave. B and constructing culvert has been awarded to CHARLES MURRAY, at $32,711. Bids were opened Sept. 29 by the Board of Contract & Supply.

NEW YORK, N. Y.—Bids will be received until Oct. 27 by George Cromwell, Pres. Richmond Boro., St. George, New Brighton, for furnishing and delivering 21,000 tons of 1½-in. and ¾-in. broken stone and screenings of trap rock or Staten Island syenite at such points and in such quantities from time to time as the Superintendent of Highways may direct, upon the roads in the First, Second, Third and Fourth Wards, Borough of Richmond.

SYRACUSE, N. Y.—Bids are asked until 1.30 p. m., Oct. 26, by the Board of Contract and Supply, for constructing stone, brick, cement or asphalt sidewalks on certain streets. George J. Metz is City Clk.

ROCHESTER, N. Y.—The following bids were opened on Oct. 8 by the Board of Contract and Supply for paving with asphalt a portion of Alexander St.: Whitmore, Rauber & Vicinus, 279 South Ave., $10,328; Rochester Vulcanite Pavement Co., Alexander St. and Erie Canal, $10,471.

ALBANY, N. Y.—The Board of Contract and Supply on Sept. 30 awarded the contract to JOHN M. HOLLER, 513 Western Ave., for paving Orange and Stanwix Sts., at about $40,796.

NEW YORK, N. Y.—Bids were received as follows on Oct. 15 by Louis F. Haffen, Pres. Boro. of the Bronx, for (a) repaving with asphalt blocks on a concrete foundation the roadway of Webster Ave., from Welch St. to Fordham Square and setting curb where necessary and (b) repaving with asphalt blocks on a concrete foundation the roadway of St. Anne Ave. from Rae St. to Third Ave., and setting curb where necessary: Continental Asphalt Paving Co., 79 Wall St., (a) $9,284; (b) $32,492; Barber Asphalt Paving Co., 114 Liberty St., (a) $9,233; (b) $32,113; Hasting Pavement Co., 25 Broad St., (a) $9,431; (b) $31,557; Asphalt Construction Co., Madison Ave. and 137th St., (a) $9,077; (b) $32,635.

Bids were received as follows on Oct. 15 by the Park Board for furnishing and delivering new 5-in. bluestone curbstones along Broadway, where required, between 65th and 80th Sts.: Martin P. Lodge, 172 West 97th St., $1.15; 75 cts.; W. J. Fitzgerald, 547 West 45th St., $1.23; 72 cts.; Bart Dunn, 444 East 68th St., $1.22, 73 cts.

NEW YORK, N. Y.—Bids were received as follows on Oct. 15 by Louis F. Haffen, Pres. Boro. of the Bronx, for paving with asphalt pavement or with mineral rubber pavement on a concrete foundation the roadways and sidewalks of the bridges over the New York, New Haven & Hartford R. R. (Harlem River branch) at Longwood Ave., Tiffany St., Hunt's Point Road, Faile St., Bryant St., Westchester Ave., Tremont Ave., West Farms Road, White Road, Unionport Road, Williamsbridge Road and Baychester Ave.: Barber Asphalt Paving Co., 114 Liberty St., $36,577; Standard Asphalt & Construction Co., $52,380; U. S. & Venezuela Asphalt Co., $42,086.

Bids were opened as follows by Louis F. Haffen, Pres. Boro. of the Bronx, on Oct. 15 for furnishing and delivering broken trap rock stone and screenings: Clinton Point Stone Co., 115 Broadway, $31,500; Manhattan Trap Rock Co., 30 Church St., $28,950; Jacob E. Conklin, 229 Broadway, $28,500.

*CAPE MAY, N. J.—Bids will be received by the Board of Chosen Freeholders of Cape May County, N. J., until noon, Nov. 4, at Cape May Court House, N. J., for the construction of a gravel road from the northeast end of the bridge over Cape Island Creek at Schellenger's Landing, to the center line of the Main Sea Shore Road at Cold Spring, a distance of 2.094 miles, and known as the Schellengers Landing Road, the road to be constructed according to plans and specifications which may be seen at the office of Hon. Frederick Gilkyson, State Comr. of Pub. Rds., Trenton, N. J.; at the residence of A. Smith, Dir., Beesleys Point; J. P. Fox, Ocean City; Charles Clouting, Sea Isle City; J. D. Ludlam, South Dennis; Daniel Schellenger, Cold Spring; and Henry S. Rutherford, Cape May City, or at the office of the Engineer at Ocean City, N. J. R. Fendall Smith is County Engr.

WILKES-BARRE, PA.—Bids will be received until Oct. 26, by State Highway Department, Harrisburg, Pa., for constructing 7,183 ft. of state road in Hemlock Township and 25,534 ft. of state road and one bridge in Plymouth Township.

HARRISBURG, PA.—The councils on Oct. 12 awarded to the WARNER-QUINLAN PAVING CO., the contract for the paving of Thompson St. from 16th to 17th Sts., at $1.94 per sq. yd. for asphalt, and 94 cts. per ft. for granite curbing. The only other bidder was the Barber Asphalt Paving Co., at $1.97 and 99 cts.

CUMBERLAND, MD.—Bids are asked by Allegany County until Oct. 22 for grading and macadamizing the road between Westernport and Barton, Md., distance of about 1¼ miles. Clinton Uhl is Chn. Road Directors.

BALTIMORE, MD.—James C. Cremen, Chappell and Carey Sts., Baltimore, has submitted the lowest bid at $5,943 for improving Glen Ave., from Park Heights Ave. to the Reisterstown road. B. T. Fendall is City Engr.

MARTINSBURG, W. VA.—The city has awarded the contract to the H. C. BROOKS CO., Fairmont, W. Va., for paving the public square with brick at 70 cts. per sq. yd. Total, about $6,000.

SALISBURY, N. C.—We are officially advised that all bids for constructing roadway, sidewalks, etc., the Salisbury National Cemetery were rejected on Oct. 16 by Maj. M. Gray Zalinski, Q. M., U. S. A., as excessive.

FLORENCE, ALA.—Bids are asked by the city for grading and graveling Sweetwater, Limestone, Spring and other streets, until Oct. 24; L. H. Gass is City Engr.

OXFORD, MISS.—The city has voted $25,000 of bonds for the construction of concrete sidewalks, etc. R. S. Adams is Mayor.

MAYSVILLE, KY.—FORMAN & FRAZIER, Lexington, Ky., have been awarded the contract for the construction of sidewalks here.

LEXINGTON, KY.—Bids are asked by the city until Oct. 31 for constructing concrete sidewalks, guttering and curbing on Sixth St., North Upper St., Seventh St. and North Limestone St. W. M. Bateman is Supt. Pub. Wks.

COLUMBUS, OHIO.—Bids will be received by E. W. Hirsch, Secy. Pub. Ser., until Oct. 23 for the improvement of Haviland Ave., Highland St., Hill Ave. and Miami Ave. Plans and specifications may be seen at the office of Henry Maetzel, City Engr.

TOLEDO, OHIO.—The City Engineer has estimated the cost of repaving Auburn Ave., from Monroe to Central Ave. at $25,000 for broken stone and $31,000 for concrete. Frank I. Consaul is City Engr.

ASHLAND, OHIO.—Bids will be received until Nov. 9 by the Mayor and Village Council for furnishing material and constructing sidewalks and grading a portion of Carroll St.; and for grading, curbing and paving a portion of Church St. E. L. Black is Engr.

CLEVELAND, OHIO.—Bids will be received until Oct. 31 by the County Commissioners, William F. Black, Clk., for grading, draining and improving a portion of Harvard Road. A. B. Lea is County Surv.

COLUMBUS, IND.—Bids will be received until Nov. 2 by John M. Davis, County Audr., Columbus, for constructing 6,325 ft. of road in Ohio Township.

SOUTH BEND, IND.—A. J. Hammond, City Engr., is preparing plans for 6,000 sq. yds. of tarviated macadam for Leland Ave. and 11,000 sq. yds. brick pavement for Allen St.

MONTICELLO, IND.—Bids will be received by the Commissioners of White County until noon, Nov. 4, for the construction of a gravel road in Union Township. J. L. Ackerman is County Audr.

LAFAYETTE, IND.—Bids will be received by the Board of Commissioners until 10 a. m., Nov. 6, for the construction of the Hagaman gravel road in Wabash Township. John P. Foresman is County Audr.

INDIANAPOLIS, IND.—Bids will be received by the Board of County Commissioners until 2 p. m., Nov. 6, for the construction of a gravel road on the line between Marion and Hancock Counties; length of said road, 3,984 ft. Albert Salm is County Audr.

CORYDON, IND.—Bids are asked by the Commissioners of Harrison County until 2 p. m., Nov. 4, for the construction of a gravel or macadamized road in Jackson Township, and for the construction of a gravel or macadamized road in Spencer Township. Frank E. Watson is County Audr.

GREENFIELD, IND.—Bids are asked by the Commissioners of Hancock County until 2 p. m., Nov. 2, for the construction of 11,296 ft. of gravel road in Buck Creek Township. Chas. H. Troy is County Audr.

MUNCIE, IND.—Bids are asked by the Commissioners of Delaware County until 10 a. m., Nov. 4, for the construction of the following gravel roads: The Meek road, the Cecil road, the Stiffer road, the Duncan road and the Carmichael road, in Liberty Township; the Dragoo road, the Hawkins road, the Fadely road, the Wilson road, the Rigman road, the Everett road and the Williams road in Center Township; and the Davis roads in Delaware Township. Joseph E. Davis is County Audr.

HARTFORD CITY, IND.—Bids are asked by the Commissioners of Blackford County until noon, Nov. 2, for the construction of 15,838 ft. of gravel road in Washington Township. L. W. Daugherty is County Audr.

LAFAYETTE, IND.—Bids will be received by the County Commissioners until 10 a. m., Nov. 6, for the construction of a gravel road on the line between Tippecanoe and Wabash Township. John P. Foresman is County Audr.

INDIANAPOLIS, IND.—Bids will be received until Nov. 20, by the Board of Public Works for the following street improvements: Portions of Gladstone Ave., by paving with brick; 13th St., by paving with bitulithic; York St., cement walks, curbing, brick gutters and gravel roadway; Parker Ave., paving with asphalt and brick gutters; Union St., paving with asphalt, and cement walks in Rural St., Park Ave., 31st St. and Laselle St.

NORMAL, ILL.—The following bids were opened on Oct. 7 by O. L. Manchester, Pres. Bd. Local Improvements, for constructing approximately (a) 22,000 sq. yds. brick block pavement, (b) 9,600 cu. yds. grading and (c) 16,200 lin. ft. curb and gutter: I. D. Lain, (a) $1.48 per sq. yd., (b) 30 cts. per cu. yd., (c) 47 cts. per lin. ft.; A. E. Franks, (a) $1.85, (b) 28 cts., (c) 50 cts.; R. L. Williams, (a) $1.78, (b) 28 cts., (c) 48 cts.

EAST ST. LOUIS, ILL.—We are officially advised that bids were received as follows on Oct. 10 by the Board of Public Improvements for the improvement of (a) Virginia Place and (b) 33d St.: KEELEY & GAYNORD, (a) $11,869; (b) $10,743 (awarded contract); W. H. Hill, (a) $12,316; (b) $11,412; Walter Coonan, (a) $13,071; (b) $12,180.

OAKDALE, IOWA.—The CEDAR FALLS CEMENT CO. has secured the contract for 12,000 sq. ft. of cement paving at the Iowa Tuberculosis Hospital.

GRAND RAPIDS, MINN.—Bids will be received until Oct. 24 by A. Spang, County Audr., for constructing a county road.

ST. JOSEPH, MO.—The Board of Public Works on Oct. 6 awarded contracts for paving with brick portions of Edmond, 26th and 21st Sts. to H. N. RICE, at $1.40, $1.48 and $1.85 per sq. yd. respectively.

SALEM, ARK.—Fulton County will construct a road between Salem and Mammoth Spring, Ark., for which $5,000 has been appropriated.

AUSTIN, TEX.—The city has awarded the contract to WILLIAM J. HEFFRON, Galveston, Tex., at $2.20 per sq. yd. for the construction of about 4,965 sq. yds. of vitrified paving blocks on West Sixth St. G. S. Iredell is City Engr.

HOUSTON, TEX.—T. C. Tarver, City Engr., and C. L. Bernay, Assistant City Engr., are preparing plans for the relaying of Congress avenue. The city has purchased 1,225,000 paving blocks from the Thurber Brick & Tile Co., of Thurber, Tex., at about $26,000. About 26,000 sq. yds. are to be resurfaced with vitrified paving blocks and bids for paving with brick Congress Ave. and for other paving work will soon be asked.

MONTESANO, WASH.—The City Council has awarded the contract for the improvement of Home St. and First St. in Fleet's addition, to FRANK TUTTLE.

EVERETT, WASH.—The Board of Public Works has instructed the City Engineer to prepare plans and specifications for improving Chestnut St. from Hewitt to Pacific Aves. preferably with brick paving.

COQUILLE, ORE.—All bids for the paving of Front St. have been rejected. New specifications will be prepared and new bids asked.

SALT LAKE CITY, UTAH.—We are officially advised that P. J. MORAN, Salt Lake City, the only bidder, was awarded the contract on Oct. 9 by the Board of Public Works for the construction of paving extension No. 47, at $3,660. L. C. Kelsey is City Engr.

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

WATERBURY, CONN.—The Chase Rolling Mill Co. has taken out a permit for the erection of an additional factory on East Farm St. The structure will be of brick, one story high, 60 × 120 ft.

The Scoville Mfg. Co. has completed plans for the erection of a 1-story factory, 73 × 111 ft. The work will be done by the company.

The Blake & Johnson Mfg. Co., makers of brass specialties, has awarded to the TRACY BROS. CO. the contract for the erection of a large factory. The structure will be of brick, 200 × 260 ft., and it will contain one story and a basement.

ESSEX, CONN.—The Tiley Pratt Co. has awarded the contract for the steel work on its new factory to the BERLIN IRON BRIDGE CO., Berlin, Conn.

MIDDLETOWN, CONN.—The Frisbie Motor Co. will erect a new factory on Center St., on what is known as the Armour property.

ALSEN, N. Y.—We are officially advised that the TURNER CONSTRUCTION CO., 11 Broadway, New York, has been awarded the general contract by the Alsen American Portland Cement Co. for the construction of a cement stock house 200 ft. long by 38 ft. wide by 34 ft. high at its mills at Alsen, N. Y. These cement bins will be of reinforced concrete throughout. Work will be undertaken at once.

ROCHESTER, N. Y.—The H[illegible] Wagon & Carriage Co. is having plans prepared by Otto Block, Arch., 815 Wilder Bldg., for a 1-story and basement factory [illegible], 44 × 124 ft., of brick and concrete [illegible] construction, to be erected on St. [illegible] St. Estimated cost, $10,000.

The mason contract for the [illegible]-story brick factory building, 125 × 143 ft., to be erected by G. W. Todd & Co. on University Ave., has been awarded to GORSLINE, SWAN & RICE, and the carpentry to the THOMAS W. FINUCANE CO. Gordon & [illegible]den, 300 Sibley Bldg., are Archs.

LOCKPORT, N. Y.—The [illegible]quehanna Smelting Co., which recently located at Lockport, N. Y., in the factory buildings formerly occupied by the Holly Mfg. Co., has completed plans for a $10,000 addition to its plant.

CARTHAGE, N. Y.—Gallagher & Greene, proprietors of the Wilna Machine Co., Carthage, N. Y., have purchased property adjoining the Kesler Block, and [illegible] erect a 1-story foundry and machine shop. The firm is engaged principally in the manufacture of gas engines.

FULTON, N. Y.—It is planned to remodel the entire power plant conected with the Fulton Worsted Mills at Fulton [illegible] by the American Woolen Co. At the upper falls the dam is to be raised 6 ft. in order to conform to the barge canal plans, and the headgates of the raceway and wall will be rebuilt and strengthened. It is reported that with the power obtained from the waterwheels dynamos will be operated and the electricity applied to whatever portion of the plant desired.

OSWEGO, N. Y.—The Ontario Knitting Co. is planning the erection of an entire new plant at a cost of about $300,000.

Plans are being made to increase the size of the Diamond Match Co.'s plant. An addition costing about $200,000 is reported contemplated.

NEW YORK, N. Y.—We are officially advised that the RAYMOND CONCRETE PILE CO., of New York and Chicago, through Chas. F. Uebelacker, Chief Engineer, Metropolitan Street Railway Company, has been awarded a contract for placing concrete piles in the foundations of the new car barns that are to be erected at 54th St. and Ninth Ave., New York. Charles F. Uebelacker is Ch. Engr. Metropolitan St. Ry. Co.

BUFFALO, N. Y.—The Nowak Elevator at Broadway and Curtiss Sts. was destroyed by fire recently. It is stated that a plant to cost about $100,000 will be erected at once. A. Nowak & Son Co. are the owners.

The Jacob Dold Packing Co. had plans completed and is receiving bids for a 1-story concrete, brick and steel boiler house for its plant on William St. and New York Central & Hudson River R. R. tracks. The offices of the company are at 745 William St. Edward F. Dold is Secy.

M. A. Hanna & Co., of Cleveland, have secured a tract of land having 3,000 ft. of frontage on Niagara River near the Wickwire Steel Co.'s furnace, and will build upon the property a $3,000,000 plant for the production of pig iron. The plant will consist of two blast furnaces, coke ovens, concrete ore docks and bins, ore unloaders and carriers and complete equipment of machinery for handling ore, coal and finished product. The property is intersected by the Erie Canal and the plant will have canal transportation facilities as well as lake transportation and will be furnished railroad facilities by the Niagara River Industrial lines of the N. Y. C. & H. R. R. R. Co. Noted last week.

PATERSON, N. J.—We are officially advised that the Columbia Ribbon Co., Paterson, contemplates building a factory. John Grossgebauer is Pres. and Gen. Mgr.

SHARON, PA.—The Petroleum Iron Co. will build an addition to its plant south of the town. The plate mill will be lengthened about 160 ft., which will increase the capacity of the work and give additional floor space. The excavations will be started at once, but the improvements will not be finished before next spring. New machinery is to be added.

McKEESPORT, PA.—The Rooling Fly Screen & Shutter Co. intends to build a plant in McKeesport. It has a capital stock of $300,000.

NATIONAL SOLDIERS' HOME, VA.—See item under Buildings.

PAXTON, FLA.—We are officially advised that the Lake Jackson Turpentine Co., of Paxton, is preparing to erect a new wood turpentine still, to be operated by steam process. Part of the machinery is already on hand.

CHATTANOOGA, TENN.—The Fuller Combing Gin Co. has accepted the plans of HOWARD EGLESTON, Arch., 427 James Bldg., Chattanooga, for its proposed factory building. It will be of reinforced concrete throughout and the Kahn system of reinforcement will be used. The first building to be erected will be two stories, 16 ft. high, each ground plan, 60 × 260 ft., bays 20 × 20 ft. Mr. Egleston has secured the contract to erect all the buildings.

COLUMBIA, TENN.—The Riverside Planing Mills, recently burned, will be rebuilt. A factory, 60 × 80 ft., warehouse, 30 × 100 ft., and boiler and engine room will be erected. Total floor space, 15,600 ft. Cost of buildings and equipment, $12,000. J. B. Borum, Secy. and Treas.

MEDINA, TENN.—The Medina Farmers' Union Gin Co., T. S. Parrish, Pres., recently incorporated, will construct a gin of 35 bales capacity, 150 × 260 ft. W. T. Lewis is Secy., Treas. and Gen. Mgr.

TOLEDO, OHIO.—The Owens Bottle Machine Co. intends to enlarge its plant. M. J. Owens is Mgr.

EVANSVILLE, IND.—The Standard Brick Mfg. Co. will build an addition to its First Ave. plant. The contract has been let to GEORGE W. GOODGE & SON.

CHICAGO, ILL.—We are officially advised that G. P. & J. W. O'CONNOR, Security Bldg., Chicago, have secured the contract to erect a manufacturing plant at 25th and Dearborn Sts., for Bauer & Block, 283 25th St. The building will be 120 x 150 ft., three stories high and will cost $75,000. It will be of steel and concrete construction. Holabird & Roach, Monadnock Block, Chicago, are Archs.

CARROLLVILLE, WIS.—H. J. Esser, Arch., Milwaukee, has prepared plans for a $35,000 fertilizer plant for the U. S. Glue Co., Carrollville, Milwaukee County. The building is to be 3-story and 100 x 125 ft.

MILWAUKEE, WIS.—The Davis Mfg. Co., 267 Sixth St., manufacturers of gasoline engines, etc., has secured a site on 15th Ave. and Park St. and will erect a factory 100 x 150 ft.

LEAVENWORTH, KAN.—The Victor Mfg. Co., Leavenworth, Kan., manufacturers of washing machines, is preparing plans for rebuilding its plant, which was destroyed by fire recently. The new plant will be larger than the old.

LEAVENWORTH, KAN.—Bids are asked by the Department of Justice, Washington, D. C., until 10 a. m., Oct. 26, for furnishing and delivering at the United States Penitentiary, Leavenworth, Kan., tanks, coils, ice cans, brine pumps, etc., to be used in extending the ice-making capacity of the refrigerating plant. R. V. Ladow, Supt. of Prisons and Prisoners, Dept. of Justice, Washington.

O'FALLON, MO.—We are advised by JOHN HAGUE, 3664 Olive St., St. Louis, Mo., that he has the contract to erect an ice plant here.

JACKSON, MO.—JOHN HAGUE, 3664 Olive St., St. Louis, Mo., advises us that he will let contract soon for a 60-HP. boiler, an 8-ton freezing system, and an 8-ton distilling system, for Goodwin & Jean, wholesale poultry dealers, Jackson.

EL PASO, TEX.—The El Paso "Times" states that the Globe Milling Co., of Los Angeles, Cal., will erect a flour mill, to cost $85,000, and an ice plant, to cost $60,000, here. W. E. Keller, Pres. of the Globe Milling Co., has purchased the site for the proposed plants.

MONROE, WASH.—Arthur Pracna is working on plans for the rebuilding of the Wagner-Wilson mill plant near Monroe, recently destroyed by fire. The new plant will cost from $100,000 to $150,000. Capacity in 10-hour run will be 100,000 ft. of lumber and 300,000 shingles.

LONG BEACH, CAL.—The plant of the San Pedro Salt Co., recently burned, will be rebuilt at once, according to press reports. The company's officers are I. L. Dunn, Pres.; B. P. Dayman, Vice-Pres.; C. J. Walker, Secy. and Treas.; William Schilling, Auditor. Offices were located at the Farmers' and Merchants' Bank of Long Beach and at 498 Pacific Electric Bldg., Los Angeles. It is capitalized at $500,000.

HAMILTON, ONT.—Steps are to be taken at once to let the contract for the car sheds, manufacturing and repair shops which the Hamilton Street Ry. Co. intends erecting. A reinforced-concrete fireproof structure is to be erected. C. K. Green is Supt. of Constr.

MISCELLANEOUS CONTRACTS.

(* *denotes that this work is advertised in Engineering News.*)

U. S. RECLAMATION SERVICE.—All news relative to canal projects, etc., will be found under Water Supply—Irrigation.

OIL.—New York, N. Y.—See under Streets and Roads.

SUBWAY ENTRANCES.—New York, N. Y.—See item under Buildings.

BROKEN STONE.—New York, N. Y.—See item under Streets and Roads.

ICE-MAKING MACHINERY.—Leavenworth, Kan.—See under Manufacturing Plants.

DITCH.—Estherville, Iowa.—Bids are asked until Nov. 11 by the County Auditor for constructing Ditch No. 16, aggregating 7,800 cu. yds.

DITCH.—Hallock, Minn.—Bids are asked until Oct. 22 by G. A. Cunnarson, County Audr., for constructing ditch No. 14, estimated to cost $8,261.

COAL MACHINERY.—Chicago, Ill.—Bids will be received until Nov. 2 by John J. Hanberg, Comr. Pub. Wks., for the coal and ashes machinery required in the new city hall.

GATES.—Ottawa, Ont.—Bids are asked by the Department of Railways and Canals, until 4 p. m., Oct. 27, for construction of the upper main gates for the Sault Ste Marie Canal.

LEVEE.—Vicksburg, Miss.—Bids are asked until noon, Nov. 3, by Capt. Clarke S. Smith, Corps Engrs., for about 123,000 cu. yds. of levee work on Red River, and about 8,000 cu. yds. on Mississippi River.

BREAKWATER.—Rondeau, Ont.—Bids will be received by Nap. Tessier, Secy., Dept. of Public Works, Ottawa, until 4:30 p. m., Oct. 27, for the construction of a breakwater and the necessary dredging at Rondeau.

DIKE.—North Mankato (Mankato Post-Office), Minn.—Bids will be received until Oct. 31 by the Village Council for furnishisng material and constructing a dike along the river. C. A. Kene, Village Recorder.

DITCH.—Glenwood, Iowa.—Bids will be received until Nov. 2 by B. T. Agan, County Aud., Glengood, for constructing Pony Creek Ditch and levees in Pony Creek Drainage Ditch No. 1, consisting of 125,158 cu. yds.

REMOVING WRECK.—Wilmington, Del.—Bids will be received by Capt. L. H. Rand, Corps Engrs., U. S. A., until Nov. 3 for removing wreck of steamer "Gulf Stream," lying sunk at entrance of Hereford Inlet, N. J.

BOATS.—Wheeling, W. Va.—Bids are asked by Capt. F. W. Altstaetter, Corps Engrs., U. S. A., until 11 a. m., Nov. 4, for furnishing and delivering two wooden-hull maneuver boats for dams Nos 13 and 18, Ohio River.

DOCK.—Welland, Ont.—Contract for construction of the Canadian Government dock at the plant of the Ontario Iron & Steel Co., south of Welland, has been awarded to JOS. BATTLE, of Thorold, Ont. Estimated cost, $50,000.

METAL LOCKERS.—Washington, D. C.—Bids will be received by Maj. M. Gray Zalinski, Depot Q. M., U. S. A., until Nov. 7 for furnishing f. o. b. at place of manufacture about 5,000 standard metal wall lockers.

*CONCRETE WHARF.—Detroit, Mich.—Bids will be received by the Public Lighting Commission until 4 p. m., Nov. 2, for constructing a concrete wharf in rear of power house. F. Mistersky, Gen. Supt., 40 Atwater St., East, Detroit.

DITCH.—Oregon, Wis.—Bids were received on Oct. 8 by George Hartlein, Secy. Bd. Comrs. of Badfish Drainage District, for main ditch, laterals and tile work. Contract has been awarded to KNIGHT & BOWEN, Madison, Wis., at $8,500. S. T. Armstrong, Sycamore, Ill., is Engr.

ENGINEERING SUPPLIES.—New York, N. Y.—Bids are asked by Geo. Cromwell, Pres. Boro. Richmond, until noon, Oct. 27, for furnishing and delivering supplies, as per schedule of articles and specifications, attached to the contract, for the Bureau of Engineering Topography.

TRESTLE.—Cincinnati, Ohio.—Part of the long single-track trestle which forms the approach to the Cincinnati terminal of the Chicago, Cincinnati & Louisville Ry., is being filled in with a bank wide enough for two or more tracks. Some curve and grade revision work is also in progress. The OALHOFF CONSTRUCTION CO., of Little Rock, Ark., has the contract for this work, and is using steam shovels and 18-yd. dump cars. E. B. Espenshado is Div. Engr., Chicago.

*DREDGE.—Mobile, Ala.—Bids are asked by Maj. H. Jervey, Corps Engrs., U. S. A., Mobile, until noon, Nov. 20, for constructing a steel hull 20-in. pump dredge for improving harbors on the coast of Mississippi. Plans and specifications are on file at office of Engineering News, New York.

DRAINAGE.—Prophetstown, Ill.—Bids will be received until Nov. 4 by the Commissioners of Big Slough Special Drainage Dist. of Henry and Whiteside Counties, Jas. H. Baird, Chn., Prophetstown, for excavating seven branches of this district, comprising about 109,074 cu. yds.

MECHANICAL EQUIPMENT. — Philadelphia, Pa.—Bids are asked by the Marine Corps, Washington, D. C., until 11 a. m., Oct. 22, for installing the mechanical equipment in extension "B," depot of supplies, 1100 South Broad St., Philadelphia, Pa. Col. F. L. Denny, Q. M., U. S. M. C.

FIRE ENGINES, ETC.—Baltimore, Md.—Bids are asked until 11 a. m., Oct. 28, by the City Register for furnishing the Board of Fire Commissioners the following: Two first-size piston steam fire engines; two Dahill hoisting devices, complete, with motors and compressors. Separate proposals are to be made for each item.

ELECTION BALLOTS.—New York, N. Y.—Bids were received as follows on Oct. 13 by the Board of Elections for furnishing and delivering official and sample ballots for election purposes: (a) 24½ ins x 26 ins., (b) 19½ ins. x 26 ins.: Martin B. Brown, 49 Park Pl., (a) $49.850; (b) $47,625; Wyncook, Hallaback & Crawford, 405 Pearl St., (a) $52,960; (b) $48,975.

CABLES.—New Haven, Conn.—Bids will be received until Oct. 27 by the Police and Fire Comrs. for furnishing the following cables: 960 ft. 75 wire; 450 ft. 50 wire; the wires to be of No. 14 B. & S. gage, of pure soft drawn copper and thoroughly tinner. Insulation to be 5.32. Compound to be of the best Para rubber used for underground insulation. The lead sheath to be of commercially desilverized lead with such alloys as are used for underground cables and of a sheathing of ⅛-in. lead.

DREDGING.—Brooklyn, N. Y.—Bids were received as follows on Oct. 14 by Bird S. Coler, Boro. Pres., for furnishing all the labor and materials required for dredging Newtown Creek Canal at and in the canal and basin included within the boundaries of Johnson Ave., Montrose Ave., Morgan Ave., Varick Ave., and also the Stage St. Basin, in the Borough of Brooklyn, City of New York: R. G. Packard, Dredging Co., 130 Pearl St., New York City, 47 cts.; U. S. Dredging & Contrg. Co., 260 Jersey City, 38 cts.; John & Jos. McSpirit, 119 Wayen St., Jersey City, 43 cts.

*BARGE CANAL.—Albany, N. Y.—Bids are asked by F. C. Stevens, Supt. Public Works, on five additional contracts for Barge Canal work, as follows: On Contracts Nos. 40 and 46 until noon, Nov. 17, and on Contracts Nos. 41, 47 and 68 until noon, Nov. 18. The aggregate cost of the work will amount to nearly $7,000,000. Details are given in the advertisement in this issue. Estimated cost is as follows: Contract No. 40, Erie Canal, Section 10, engineer's estimate, $2,516,743; Contract No. 41, Erie Canal, Section 9, estimate, $383,190; Contract No. 46, Erie Canal, Section 7, estimate, $1,367,585; Contract No. 47, Erie Canal, Section 8, estimate, $1,434,148; and Contract No. 68, Champlain Canal, Section 1, estimated cost, $1,175,623. Frederick Skene is State Engr. and Surveyor.

*RAILWAY WORK.—Philadelphia, Pa.—Bids were received on Sept. 16, by W. Hunter, Ch. Engr., 520 Reading Terminal Philadelphia, for the following work: Contract No. 31—coal pocket yard at northeast corner of Tenth and Norris Sts. Contract No. 32—masonry, embankment, paving, water and drainage systems and new freight office building in yard between Berks and Morris Sts., west side. Contract No. 35—drainage for yards between York St. and Cumberland St. Awards of contracts have been made as follows: No. 31—WILLIAM STEELE & SONS CO., 1600 Arch St., Philadelphia, at $36,181. No. 32—ARMSTRONG & LATTA CO., Land Title Bldg., Philadelphia, at $67,508; No. 35—O'TOOLE, WALLS & DEMPSEY, 105 North 13th St., Philadelphia, at $2,440. Complete list of bidders is given under Railways.

CONTRACT PRICES.

[Where * precedes item under Contract Prices the work was advertised in Engineering News.]

*WHARF, SEAWALL.—Mobile, Ala.—Bids were received on Oct. 9, by Maj. H. Jervey, Corps Engrs., U. S. A., for construction of a wharf and seawall at Fort Gaines, Dauphin Island, Ala. Bids in detail were as follows—(A) Hieronymus & Ollinger, Mobile, Ala., $79,723; (B) Richard M. Murphy, New Orleans, La., $7.542; (C) W. C. Spotswood, Mobile, $71.716; (D) Blackstaff Engineering Co., Philadelphia, Pa., $79,478; (E) Charles Clarke & Co., Galveston, Tex., $81,648; (F) Edwards Construction Co., Tampa, $128,000; (G) Grant Wilkins, Atlanta, Ga., $81,808; (H) Christie & Lowe, New Orleans, La., $67,390:

	Wharf			Seawall		
	6,003 lin. ft. round creosoted piles, in place.	117,500 ft. B. M. timber work, in place, per M. ft. B. M.	7,300 lbs. iron work, in place, per 100 lbs.	6,000 cu. yds. excavation.	1,500 cu. yds. riprap removed and relaid.	15,500 short tons riprap, hand placed.
(A)...	$0 49	$37.00	$8.00	$0.35	$1.50	$5.00
(B)...	.55	40.00	6.00	.55	1.50	4.15
(C)...	.58	52.50	7.55	.50	1.00	4.25
(D)...	.63	42.00	6.25	.25	.75	5.00
(E)...	.93	42.90	8.00	.60	1.00	4.84
(F)...	.65	39.28	7.50	.43	1.40	8.47
(G)...	.94	39.80	8.00	.61	1.00	4.87
(H)...	.60	40.00	6.00	.30	1.00	4.10

*SANITARY SEWERS.—Oxford, Ohio.—Bids were received on Sept. 29 by City Council for construction of sanitary sewers. Bids in detail were as follows—(A) M. O'Herron & Co., Pittsburg, Pa.; (B) John B. McLane, Newport, Ky.; (C) E. W. Boston, Cincinnati, Ohio; (D) McCarthy Bros., Cincinnati; (E) Henry Spinach, Waterbury, Conn.; (F) Paul & Kirchner, Dayton, Ohio; (G) Irwin Bros., Greenville, Ohio; (H) C. C. Saner, Chicago, Ohio; (I) C. T. McCracken, Columbus, Ohio; (J) Bennett Construction Co., Cincinnati; (K) Pease, Buzatt & Co., Indianapolis, Ind.; (L) John B. Truman, Lafayette, Ind.; (M) Kaps & Brehm, Portsmouth, Ohio; (N) Northwestern Construction Co., Franklin, Pa.; (O) F. C. Morgan, Vincennes, Ind.; (P) Tripper & Son, Peru, Ind.; (Q) E. M. Gephart & Co., Dayton; (R) Harmon & Sieverling, Springfield, Ohio; (S) Melcher & Morrison, Cincinnati, Ohio; (T) F. R. Stone, Lima, Ohio; (U) Price & Hurley, Marion, Ohio; (V) Thomas R. Strack, Cincinnati; (W) REESE & LARKIN, Dayton (awarded contract); (X) Andrews Asphalt Paving Co., Hamilton, Ohio; (Y) Evan Evans, Cincinnati. D. P. Boaton is Clk.; The Riggs & Sherman Co., Engrs., The Nasby, Toledo, Ohio:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
40,800 lin. ft. 8" sewer pipe, laid	$0.15	$0.14	$0.20	$0.15	$0.16	$0.15	$0.13	$0.17	$0.14	$0.17	$0.18	$0.15	$0.18
7,000 " " 10" sewer pipe, laid	.19	.19	.26	.20	.21	.22	.18	.26	.23	.22	.24	.19	.23
10,100 " " 12" sewer pipe, laid	.24	.24	.34	.30	.26	.28	.25	.34	.31	.28	.30	.25	.30
3,550 " " 15" sewer pipe, laid	.31	.36	.43	.45	.33	.40	.40	.46	.46	.40	.38	.39	.40
11,410 " " trenching under 5'	.25	.50	.27	.20	.35	.20	.25	.32	.30	.46	.28	.37	.46
32,682 " " trenching, 5' to 7'	.35	.40	.32	.40	.45	.30	.40	.39	.40	.63	.46	.48	.65
11,815 " " trenching, 7' to 9'	.44	.60	.52	.60	.65	.70	.65	.49	.70	.65	.57	.60	.69
2,540 " " trenching, 9' to 11'	.57	.75	.58	1.00	.70	.80	.90	.70	1.20	1.09	.80	.92	1.10
2,070 " " trenching, 11' to 13'	.75	1.25	.65	1.75	.80	1.20	1.20	.85	1.60	1.30	1.30	1.20	1.29
870 " " trenching, 13' to 15'	1.00	1.60	.75	2.35	1.00	2.50	1.70	1.00	3.00	1.30	1.50	1.40	1.32
870 " " trenching, 15' to 17'	....	3.00	1.00	2.35	....	4.00	2.50	1.50	4.00	1.50	2.10	1.75	1.50
4,000 " " 4" house connections	.40	.35	.50	.30	.30	.70	.25	.31	.40	.06	.30	.44	.07
500 " " 6" house connections	.44	.40	.55	.45	.32	.75	.30	.34	.50	.10	.35	.46	.11
120 manholes, each	36.00	30.00	40.00	35.00	48.00	35.00	45.00	30.00	25.00	32.80	25.00	38.80	33.00
drop manholes, each	.....	75.00	50.00	10.00	60.00	60.00	55.00	38.00	50.00	30.00	62.00	50.00	32.00
29 flush tanks, each	55.00	90.00	55.00	75.00	85.00	70.00	100.00	60.00	90.00	47.70	60.00	55.00	46.80
29 lamp holes, each	6.00	10.00	5.00	12.00	10.00	5.00	12.00	5.00	15.00	20.00	15.00	10.00	20.00
3,000 lin. ft. ¼" galvanized iron pipe	.30	.20	.50	.10	.25	.50	.30	.35	.20	.12	.25	.30	.15
40 cu. yds. concrete	6.00	4.00	6.00	3.00	6.00	8.00	10.00	7.50	6.00	9.60	8.00	6.00	.10
Totals	$43,374	$49,073	$48,642	$51,361	$53,345	$50,326	$50,301	$48,662	$54,557	$59,766	$52,014	$53,971	$61,743

	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)	(Y)
40,800 lin. ft. 8" sewer pipe, laid	$0.22	$0.22	$0.17	$0.16	$0.16	$0.21	$0.15	$0.15	$0.14	$0.17	$0.19	$0.16
7,000 " " 10" sewer pipe, laid	.28	.28	.23	.25	.21	.25	.19	.20	.18	.21	.25	.17½
10,100 " " 12" sewer pipe, laid	.32	.31	.33	.33	.27	.29	.24	.25	.25	.27	.31¼	.21
3,550 " " 15" sewer pipe, laid	.46	.35	.41	.43	.42	.34	.38	.31	.40	.40	.42½	.30
11,410 " " trenching under 5'	.21	.23	.25	.27	.29	.61	.25	.30	.40	.20	.55	.27
32,682 " " trenching, 5' to 7'	.26	.35	.45	.38	.38	.96	.29	.45	.50	.30	.57½	.37½
11,815 " " trenching, 7' to 9'	.41	.42	.80	.49	.51	1.28	.45	.65	.60	.32½	.70	.60
2,540 " " trenching, 9' to 11'	.65	.45	1.00	.66	.69	1.60	.80	.95	.75	.40	.94	.95
2,070 " " trenching, 11' to 13'	.76	.54	1.50	1.09	1.00	1.90	.95	1.25	1.00	.50	1.00	1.15
870 " " trenching, 13' to 15'	.99	.64	1.60	1.36	1.75	2.23	1.00	1.50	1.50	.60	1.00	1.25
870 " " trenching, 15' to 17'	1.50	.70	....	1.79	1.90	2.90	1.75	2.50	1.60	.90	2.00	1.30
4,000 " " 4" house connections	.30	.50	.08	.40	.30	.81	.33	.30	.50	.27	.20	.40
500 " " 6" house connections	.32	.50	.10	.45	.35	.83	.35	.50	.60	.30	.20	.40
120 manholes, each	39.50	30.00	30.00	32.00	24.00	45.00	30.00	30.00	40.00	35.00	38.00	40.00
drop manholes, each	45.00	35.00	30.00	40.00	32.00	45.00	50.00	100.00	50.00	50.00	38.00	45.00
29 flush tanks, each	65.00	85.00	50.00	65.00	50.00	125.00	65.00	60.00	100.00	65.00	50.00	75.00
29 lamp holes, each	10.00	5.00	15.00	4.00	12.00	30.00	8.00	7.00	5.00	7.00	10.00	10.00
3,000 lin. ft. ¼" galvanized iron pipe	.20	.50	.30	.35	.30	.30	.34	.30	.40	.45	.31¼	.20
40 cu. yds. concrete	8.00	7.00	5.00	6.00	4.50	7.00	8.00	6.00	5.00	7.50	7.50	10.00
Total	$44,819	$45,942	$54,338	$48,494	$46,634	$92,651	$42,291	$51,394	$55,786	$40,220	$59,641	$49,310
Less house connections							$1,495			$1,230		
							$40,796			$38,990		

SIDEWALKS—Salt Lake City, Utah.—Bids were received on Sept. 25 for sidewalk extension No. 108. A. F. Parker is City Engr. Itemized prices were as follows—(A) JAMES KENNEDY CONSTRUCTION CO., Atlas Block, Salt Lake City (awarded contract); (B) S. Birch & Sons Construction Co.; (C) J. W. Mellen; (D) Davis & Hueser:

	(A)	(B)	(C)	(D)
Abutters' Portion—				
Furnishing and laying vitrified pipe:				
420 lin. ft. 4" diameter	$0.20	$0.205	$0.25	$0.38
2,823 lin. ft. 6" diameter	.30	.35	.35	.50
1,534 lin. ft. 8" diameter	.43	.45	.45	.60
129 lin. ft. 10" diameter	.60	.63	.55	.70
1,511 lin. ft. 12" diameter	.85	.80	.70	.80
180 lin. ft. 15" diameter	1.10	1.00	.90	.90
30 lin. ft. 18" diameter	2.25	1.50	1.10	1.10
957 lin. ft. 24" diameter	2.70	2.35	1.80	2.25
2.13 acres grubbing brush	30.00	100.00	72.00	50.00
14.13 cu. yds. concrete in gore walls	15.00	15.00	95.12	25.00
Grading:				
39,989.7 cu. yds. excavation	.70	.80	.67	1.00
Cement pavement:				
938,694.48 sq. ft. 4" thick	.125	.127	.13	.145
12,880 sq. ft. 6" thick	.17	.20	.17	.195
33.28 M. ft. B. M. furnishing and setting foot bridges, per M. ft. B. M.	40.00	60.00	60.00	60.00
1.36 M. ft. B. M. flumes, per M. ft. B. M.	37.00	60.00	45.00	50.00
6,440 lin. ft. driveway guard timbers	.20	.15	.14	.10
Removing trees:				
285 6" or less diameter	2.00	2.50	2.50	2.00
183 6" to 12" diameter	4.00	5.00	5.00	5.00
299 12" and over diameter	7.00	5.00	7.50	7.00
238,826.52 front feet abutting property, cost per front foot	.672	.697	.686	.805
Total abutters' portion	$160,361	$166,402	$163,745	$192,197
City's Portion—				
Grading:				
44,221.2 cu. yds. excavation	.70	.80	.67	1.00
36,617.8 sq. ft. cement pavement, 4" thick	.125	.125	.13	.145
16,327.8 sq. ft. cement pavement, 4" thick	.17	.18	.17	.195
Furnishing and setting:				
68,100 ft. B. M. flumes, per M. ft. B. M.	37.00	55.00	45.00	50.00
8,163.9 lin. ft. driveway guard timbers	.20	.15	.14	.10
Removing trees:				
5 6" or less diameter	2.00	2.50	2.50	2.00
6 6" to 12" diameter	4.00	5.00	5.00	5.00
23 12" and over diameter	7.00	5.00	7.50	7.00
Total city's portion	$42,656	$48,021	$41,587	$57,338
Grand Total	$203,017	$214,424	$205,332	$249,535

STEEL BRIDGE SUPERSTRUCTURES.—Albany, N. Y.—Bids were received by F. C. Stevens, Supt. of Public Works, on Oct. 1st, for Barge Canal Contract No. 13, which is for furnishing and erecting in place five steel highway bridge superstructures over the Barge canal at various points. Itemized bids were as follows—(1) Engineer's estimate; (2) The Lane Bridge Co., Painted Post, N. Y.; (3) United Construction Co., 467 Broadway, Albany, N. Y.; (4) M. Fitzgerald, Hoosick Falls, N. Y.; (5) Penn Bridge Co., Beaver Falls, Pa.; (6) L. F. Shoemaker & Co., Harrison Bldg., Philadelphia, Pa.; (7) J. B. & J. M. Cornell Co., 26th St. and 11th Ave., New York; (8) Groton Bridge Co., Groton, N. Y.; (9) McClintic-Marshall Construction Co., Pottstown, Pa.; (10) Montour Steel Co., Montour Falls, N. Y.:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Contract No. 12—Erie Canal, Section 6:										
300,000 lbs. structural steel	$0.05	$0.0423	$0.045	$0.046	$0.0375	$0.048	$0.0433	$0.0442	$0.0425	$0.044
6.5 M. ft. B. M. yellow pine or Douglas fir sawed lumber, per M. ft. B. M.	55.00	38.00	40.00	53.00	50.00	60.00	53.85	54.00	42.00	45.00
760 sq. yds. wooden pavement	2.75	2.50	2.75	3.00	2.50	3.00	2.65	2.50	1.50	2.50
6 cu. yds. setting stone coping	2.00	2.00	2.00	2.00	2.50	2.50	2.40	2.00	2.00	2.00
6 cu. yds. lining	2.00	2.00	2.00	2.00	2.50	2.00	2.40	2.00	2.00	2.00
Contract No. 18—Erie Canal, Section 4:										
210,000 lbs. structural steel	.05	.0423	.045	.046	.0406	.048	.0433	.0442	.0425	.044
5 M. ft. B. M. yellow pine or Douglas fir sawed lumber, per M. ft. B. M.	55.00	38.00	40.00	53.00	50.00	60.00	53.85	54.00	42.00	45.00
550 sq. yds. wooden pavement	2.75	2.50	2.75	3.00	2.50	3.00	2.73	2.50	1.50	2.50
4 cu. yds. setting stone coping	2.00	2.00	2.00	2.00	2.50	2.50	2.40	2.00	2.00	2.00
4 cu. yds. lining	2.00	2.00	2.00	2.00	2.50	2.00	2.40	2.00	2.00	2.00
Totals	$29,775	$25,325	$27,052	$28,039	$23,676	$29,145	$26,266	$26,478	$24,163	$26,272

U. S. POSSESSIONS AND CUBA.

ROCK CRUSHING PLANT.—Panama.—Bids were received as follows on Oct. 19 at the office of the Isthmian Canal Commission, Washington, D. C., for the construction of a rock crushing plant having a minimum capacity of 300 cu. yds. per hour, to be erected on the south side of Sisa Hill, near La Boca: Allis-Chalmers Co., Milwaukee, Wis., $76,221; 180 days; bidding on a plant of their own manufacture. C. L. Inslee, New York, $71,515; 190 days; plant manufactured by Chalmers & Williams, Chicago, and Westinghouse Electric & Mfg. Co., Pittsburg, Pa. Motley, Green & Co., New York, $69,616.38; 200 days; plant manufactured by Power & Mining Machinery Co., Cudahy, Wis.

*CRANES.—Panama.—Bids are asked by the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10.30 a. m., November 16, for three rapid unloading cranes.

CIVIL SERVICE EXAMINATIONS.

SCIENTIFIC ASSISTANT.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Nov. 17 to secure eligibles from which to make certification to fill a vacancy in the position of Scientific Assistant (male) in the office of the Inspector of the Third Light-house District at Tompkinsville, N. Y., at $150 per month, and vacancies requiring similar qualifications as they may occur in that service. Age limit, 20 to 35 years. Application Form 1312.

ASSISTANT.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Nov. 16-17, to secure eligibles from which to make certification to fill a vacancy in the position of Assistant (male), at $1,000 a year, in the Naval Observatory, Navy Department, Washington, D. C., and vacancies requiring similar qualifications as they may occur. Age limit, 20 years or over, but preference in appointment will be given to eligibles under 35 years of age. Application Form 1312.

ELECTRICAL ENGINEER AND DRAFTSMAN.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Nov. 23-24-25, to secure eligibles from which to make certification to fill a vacancy in the position of Electrical Engineer and Draftsman in the office of the Supervising Architect, Treasury Department, Washington, D. C., at $1,200 a year, and vacancies requiring similar qualifications as they may occur. Age limit, 20 years or over. Application Form 1312.

ASSISTANT.—Washington, D. C.—The U. S. Civil Service Commission announces the postponement to Nov. 19, of the examination scheduled for Nov. 9, to secure eligibles from which to make certification to fill two vacancies in the position of Assistant in Agricultural Education in the Office of Experiment Stations, Department of Agriculture, at salaries ranging from $1,400 to $1,800 a year, and vacancies requiring similar qualifications as they may occur in that Department. Age limit, 21 to 45 years. Application Form 304 and special form. Applications must be filed prior to closing hour on Nov. 19.

OFFICE ENGINEER.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Nov. 25 to secure eligibles from which to make certification to fill three or more vacancies in the position of Office Engineer in Irrigation and Drainage Investigations, Office of Experiment Stations, Department of Agriculture, at salaries ranging from $1,200 to $2,000 a year, and vacancies requiring similar qualifications as they may occur in that Department. The duties of this position will be performed chiefly, although not exclusively, at Washington, D. C., and will consist largely of conducting general correspondence, administering office details, editing technical reports and manuscripts, verifying computations and estimates, making abstracts, and supervising field work. Since the duties of the positions to be filled from the register established through this examination are so varied, a lack of training along any single line mentioned will not bar a competitor if he has sufficiently high qualifications along the other lines. Men only will be admitted to this examination. Age limit, 21 years or over. Application Form 1312.

INDUSTRIAL NOTES.

THE ILLINOIS CENTRAL R. R., according to a statement given out by President J. T. Harahan, has ordered, this month, $1,000,000 worth of additional cars for freight service.

D. C. & WM. B. JACKSON, engineers, announce that they have opened an eastern office in the India Bldg., 84 State St., Boston, Mass., in addition to their western office in Chicago.

W. & L. E. GURLEY, Troy, N. Y. have opened a branch factory for the manufacture and repair of civil engineer's and surveyor's instruments in the Manufacturers' Exchange Building, Seattle, Wash. This branch is in charge of W. J. Ranken, Jr.

THE A. S. CAMERON STEAM PUMP WORKS, of New York City, have added a condenser department and are now prepared to build jet, surface and barometric condensers, and solicit opportunities to bid upon specifications and requirements in that line.

THE ERNST WIENER CO., 66 Broad St., New York, reports the receipt of an order from a large contracting company for 35 gondola cars, 80,000 lbs. capacity. These cars are to be used for the purpose of carrying material for filling in suburban districts. Delivery will be made about Dec. 1.

C. R. ROBINSON, formerly Sales Agent for the Inland Steel Co., of Chicago, resigned on Oct. 3 to accept the position of Chicago representative for the Lackawanna Steel Co., under the title of District Sales Agent, with offices in the Commercial National Bank Building, rooms 1726-1728.

THE ABERTHAW CONSTRUCTION CO., of Boston, Masss., has completed the rebuilding of the manufacturing buildings for Samuel Cabot, Inc., in the burnt district of Chelsea, Mass. Absolute indestructibility has been sought in this construction and reinforced concrete has been used throughout: the windows are of wired glass with metal sash and all doors are fireproof.

THE WHITING FOUNDRY EQUIPMENT CO., Harvey, Ill., states that it recently furnished the Standard Cast Iron Pipe & Foundry Co., Bristol, Pa., with two Standard No. 12 cupolas, which are notable for their size, having a capacity of 30 to 35 tons per hour. The shell is 108" in diameter, and wind box 130", with a 10½" lining, and it is fitted with two rows of tuyeres, eight in each row.

THE G. M. McKELVAY CO., of Youngstown, O., has placed an order with the Nernst Lamp Co. for the new Westinghouse Nernst lamp for the entire lighting of its new 4-story store building, to be occupied this month. The installation will consist of 36 three glower lamps for the first floor, 69 two glower lamps for the second and third floors and 75 132-watt lamps for the basement and fourth floor.

THE EDISON PORTLAND CEMENT CO., St James Bldg., New York City, held an excursion to its works on Saturday, Oct. 10, which was attended by engineers of New York City, contractors, builders and dealers from New England and New Jersey. At the mill at New Village, N. J., the guests, 202 in number, were told off in squads of ten or more men and began the tour of inspection, being led by guides who explained all the working of the various processes.

THE CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio, having discontinued the manufacture of cars for many years past, and realizing the importance of a more descriptive firm name, the Cleveland Crane & Car Co. will hereafter be known and operate as the Cleveland Crane & Engineering Co.; under such title its production will be confined to the exclusive manufacture of cranes of every description, including traveling, gantrys, mono-rail and grab-bucket handling equipment of various types.

JOHN F. ALLEN, 370-372 GERARD AVE., New York City, reports the recent sale of an Allen riveter to the Paris Bridge Co., Paris, Ill., also two riveters to the St. Louis plant of the American Car & Foundry Co. and two riveters to the Johnstown, Pa., plant of the Cambria Steel Co. One of the latter is a special riveter to exert 80 tons pressure on the rivet, with a reach of 60" and 22" gap. The enormous pressure required necessitated special parts and bearings, to avoid crushing same, all of which have been carefully arranged for.

OLIVER & BURR, 1 Madison Ave., New York, are installing the Clinton Fireproofing System in the new residence being erected for W. K. Vanderbilt at 52d St., New York, for which Warren & Wetmore are Architects. This firm has also just completed the new Masonic Temple in Brooklyn, for which Lord & Hewlett were Architects. The Clinton fireproofing system was used throughout in the new buildings for the Brooklyn Rapid Transit Co., Nostrand Ave. and President St., Brooklyn, and is also being installed in the new Chelsea piers for the City of New York.

THE STANDARD GAUGE MFG. CO., manufacturers of indicating and recording gages at Syracuse, N. Y., will move its plant and main office to a new factory at Foxboro, Mass., on or about Nov. 1. Through this change the manufacturing capacity will be greatly increased, since the two main buildings have available floor space of 100,000 sq. ft., besides separate buildings for the foundry, blacksmith shop, carpenter shop and power plant. The sales office addresses will be as heretofore: New York, 1770 Hudson Terminal, Fulton Bldg., and Chicago, 752 Monadnock Bldg.

THE H. W. JOHNS-MANVILLE CO., of New York, has placed on the market an "indestructible" smoke jack, con[illegible] of only three separate parts, each of w[illegible] is in one piece without seam or joint. [illegible] materials used in its construction are [illegible] to be absolutely fire and acid proof. [illegible]hood, cylindrical stack and cowl are [illegible]ucted at the place of erection from [illegible]ials and molds furnished by the compa[illegible] being reinforced with heavy galvaniz[illegible] iron wire cloth imbedded in the plastic [illegible]al. In a few hours the material sets [illegible] and the three parts are fastened togeth[illegible] "Phoenix" compound producing a [illegible]iece jack with a perfectly smooth interio[illegible]bstructed by protruding bolt heads or fla[illegible].

THE BERGER MFG. CO., of [illegible]nton, O., under date of September 22, m[illegible] announcement of installing ten additio[illegible] sheet mills complete with all necessary equ[illegible]ent. This will mean for the company a [illegible] of 21 sheet mills, or a sheet tonnag[illegible] 7,500 to 8,000 tons per month. Additio[illegible] mills are necessary for the increased ton[illegible] that will be required for the new spec[illegible], which the Berger Co. are about to [illegible] to their present line of manufacture. T[illegible] contracts for the structural buildings—140 [illegible] 250, 60 × 80 and 40 × 70—were placed with the Pittsburg Bridge & Iron Co., Pittsburg, Pa. The brick and concrete buildings—50 × 210 and 80 × 250—will be placed with a C[illegible] concern. It is expected to have the new mills in operation by March or April next.

IMPROVEMENTS IN MACHINERY owned by The Rail Joint Co., of New York, for the manufacture of their base supporting rail joints, are constantly being added to their plants for the making of their products for standard tee and girder rail sections, also various types of rail joints for insulated work. The joining of odd sections of rail, with perfect alinement, is accomplished with their latest compromise or step joints. The total output of this company is shown by their records at the close of September as being more than sufficient to equip over 50,000 miles of railway—deliveries having been made throughout the United States and foreign countries to that extent during the past fourteen years, being enough to construct a double track railway around the globe.

THE T. L. SMITH CO., Majestic Building, Milwaukee, Wis., is successor to the Contractors' Supply & Equipment Co., Old Colony Building, Chicago, and has its branch office at the latter address. Under an agreement made in February last, the T. L. Smith Co. purchased the business, good-will, patents, etc., of the Contractors' Supply & Equipment Co., the understanding being that the latter was to solicit no new business and was to settle up its affairs as soon as possible. For a time all business at the Chicago office was transacted in the name of the old company, the advertising being carried on in the joint names of the two companies. On Aug. 28, the T. L. Smith Co. took full charge of the office at 305 Old Colony Building, where it is now doing business, selling the Smith concrete mixers and Symons crushers, formerly handled by the other company. Mr. A. N. Fitzsimmons has succeeded Mr. Geo. C. Marsh as Sales Manager of the new company, and is also Manager of the Chicago office.

A NEW STEEL CAR MANUFACTURING PLANT is in operation at Bettendorf, Iowa, a suburb of Davenport, by the Bettendorf Axle Co. The works is an outgrowth of the plant for the manufacture of pressed steel car parts, formerly located in Davenport. The new site covers an area of 70 acres, on which has been erected a main shop, 700 × 240 ft., containing an extensive equipment of hydraulic presses. Over 60 are in use with capacities ranging from 50 to 1,800 tons. All the special hydraulic machinery was designed and built by the company. Besides this main shop building, a power house of 1,000 HP. capacity, paint shop, material yards, blacksmith and machine shop, 50 × 380 ft. have been erected. Starting in ten years go with the manufacture of Bettendorf bolsters, of which over half a million are now in service, the enterprise has been developed for the manufacture of steel car underframes, steel trucks and finally complete tank and freight cars. Recently the shops completed an order for 1,000 gondola cars for the Chicago, Burlington & Quincy R. R., and an order for 2,500 steel underframes for the Chicago, Milwaukee & St. Paul R. R. is going through the shops at the rate of 25 per day.

CURRENT ORDERS AND INQUIRIES indicate an increase in railroad buying, according to the Journal of Commerce of recent date, due mainly to the fact that materials can be obtained at lower prices. The Birmingham Southern road is in the market for 150 50-ton hopper bottom cars, to have steel bodies and underframes. The Alabama, Tennessee & Northern is in the market for 12 miles of 60-pound rails. The Iowa Central has ordered 50 all steel side dump coal cars from the Pressed Steel Car Co. The Michigan Central is having 5,000 freight cars rebuilt by the American Car & Foundry Co., the Harriman lines are obtaining figures on 220 all steel passenger cars from the Pullman Co., the Chicago, Burlington & Quincy has ordered steel passenger cars from the Pullman Co. and the Grand Trunk Pacific is figuring on 50 locomotives. The Chicago, Burlington & Quincy road also has ordered steel underframes for 12 cars from the Barney & Smith Car Co., at Aurora, Ill. As already reported at New York, the Bettendorf Axle Co. ordered 12,000 tons of structural shapes from the Illinois Steel Co. to apply on the car order received from the Chicago, Milwaukee & St. Paul road and the Standard Steel Car Co. also placed a contract with the same interest for 9,000 tons of plates and shapes to be used in the construction of the 1,000 steel cars for the Chicago & Alton Railroad. As this road has ordered another 1,000 cars a similar tonnage of steel may be expected. The Northern Pacific Railroad has specified and called for the immediate shipment of 5,000 tons of rails and 700 tons of standard sections were sold to the Van's Harbor Land & Lumber

Co., in northern Michigan. The U. S. Steel Corporation has an order for 9,000 tons of forging billets for the Standard Forgings Co. of Chicago. The steel will be used largely for steel car axles. Other railroads have called for track supplies during the week, including 1,200 tons of continuous rail joints for the Southern Pacific, 2,000 kegs of spikes for the Missouri Pacific and 2,000 kegs of spikes for the Illinois Central.

TRADE PUBLICATIONS.

SKYLIGHTS.—Thomas W. Irwin Mfg. Co., North Pittsburg, Pa. Paper; 8½ × 10¾ ins.; pp. 63; illustrated.

The various styles of skylight material are set forth by illustrations of actual installations.

CYANIDE PLANTS.—Colorado Iron Works Co., Denver, Colo. Catalog No. 10B. Paper; 6 × 9 ins.; pp. 112; illustrated.

A description of the cyanide process precedes the discussion of the machinery, tanks and appliances illustrated.

METALLIC PACKING.—C. Lee Cook Mfg. Co., Louisville, Ky. Paper; 3½ × 6½ ins.; pp. 35; illustrated.

This booklet contains sectional views and detailed descriptions of the various types of Cook's metallic packing for steam, gas and air.

RAILWAY AND MILL SUPPLIES.—The Consolidated Supply Co., 321 Dearborn St., Chicago. Catalog No. 15. Paper; 6½ × 9½ ins.; pp. 24; illustrated.

Pneumatic and electric tools and hoists are listed in this catalog, together with car replacers, couplers and other supplies.

RUST-RESISTING IRON.—American Rolling Mill Co., Middletown, Ohio. Paper; 3 × 6 ins.; pp. 14; illustrated.

A variety of low-manganese iron made by a peculiar process of this concern has been called "American Ingot Iron" and great results are claimed for its anti-rusting qualities.

CONDENSERS.—Wheeler Condenser & Engineering Co., Carteret, N. J. Bulletin No. 101. Paper; 8 × 10½ ins.; pp. 15; illustrated.

This pamphlet is the introductory section of a "Complete Catalog." It contains a discussion of the products of the above-named company, including surface, jet and barometric condensers.

PUMPS.—The Goulds Mfg. Co., Seneca Falls, N. Y. Paper; 3¾ × 6¼ ins.; pp. 8; illustrated.

Combination house force pumps are described, in this booklet, with a system of interchangeable parts, permitting the transformation of a pump for different classes of service.

HOISTING ENGINES.—S. Flory Mfg. Co., Bangor, Pa. Paper; 9½ × 12 ins.; pp. 170; illustrated.

This catalog contains pictures and brief descriptions of a great variety of steam and electric-hoisting engines and of slate cutting machinery. Tables of sizes and prices are given. Reproductions of photographs show a number of cableway installations.

RECORDING THERMOMETERS.—The Bristol Co., Waterbury, Conn. Bulletins No. 91, 92 and 93. Paper; 8 × 10½ ins.; pp. (total) 37; illustrated.

In these three bulletins are described the three classes of Bristol recording thermometers for ranges of temperature up to 250°, 500° and 800° F., respectively. Prices of the various styles under each class are listed.

TRENCHING BRACES.—Kalamazoo Foundry & Machine Co., Kalamazoo, Mich. Pp. 12; 4½ × 8½ ins.; illustrated.

This company makes a variety of trench braces mostly of the screw type with universal joint head. This catalog "makes a few suggestions as to methods in use by a number of successful contractors" and lists the various braces in stock.

MINING LOCOMOTIVES.—The Jeffrey Manufacturing Co., Columbus, Ohio. Bulletin 15. Paper; 8 × 10 ins.; pp. 16; illustrated.

This bulletin is an artistic publication, describing and picturing the use of "crab electric locomotives" for gathering mine cars from the working faces, assembling them and pushing or hauling the string to the partings.

STEAM ENGINES AND GAS ENGINES.—Wisconsin Engine Co., Corliss, Wis. Paper; 8½ × 5½ ins.; pp. 6; illustrated.

This folder expresses the company's conviction as to the superiority of the Corliss engine over the steam turbine in point of economy, reliability and durability. It also announces the company's control of Mr. C. E. Sargent's patents for a horizontal, tandem double-acting type of gas engine.

EXPANDED METAL.—Northwestern Expanded Metal Co., Old Colony Bldg., Chicago, Ill. Pp. 12; 3¾ × 6 ins.

This is one of a series of small booklets issued by this company, containing data, tables and specifications upon the subject named in the title. The standards of expanded metal are not contained in most handbooks, so this pamphlet should be useful.

SEWAGE DISPOSAL.—Ashley Sewage Disposal System (B. J. Ashley, Manager), 6315 Normal Boulevard, Chicago. Paper; 7 × 10½ ins.; pp. 24; illustrated.

The system described comprises essentially (1) a "biological" tank so constructed as to induce sedimentation and natural decomposition of the solids, with favorable conditions for bacterial growth; (2) a nitrification duct or bacteria bed which is placed underground and purifies the effluent from the tank. The system has been constructed for residences and public institutions.

CRANES AND MACHINERY.—The Morgan Engineering Co., Alliance, Ohio. Paper; 4 × 9 ins.; pp. 64; illustrated.

This is a list of users of the overhead traveling cranes built by this company. The name and address of each firm are given, with the number of machines used. The numbers used by one firm range as high as 40 and 70, with 449 by the various works of the U. S. Steel Corporation. The illustrations are views of various cranes and also of other machinery, including furnace charging machines, rolling mill plant, and machine tools of a class for heavy work.

STEEL RIBS AND LAGGING.—George W. Jackson, Inc., 175 West Jackson Boulevard, Chicago. Paper; 10 × 7½ ins.; pp. 56; illustrated.

These steel ribs and steel panels for lagging are designed for use in the construction of tunnels, dams, retaining walls, and concrete structures of all kinds. Their construction is shown, and a number of illustrations show their use in large and small tunnels and in shafts for tunnels and building foundations. They serve as the forms for concrete work, and a special arrangement provides for their use as forms in the construction of concrete buildings.

REINFORCED CONCRETE.—Concrete Column and Construction Co., 11-15 Raynor St., Detroit, Mich.; 4 × 9¼ ins.; illustrated.

This company is advocating a system known as the "Tubular Method" which briefly is described as follows: By the tubular method, thin shells or tubes of various shapes, made by machine processes of exceedingly dense concrete, are shipped to the site of a building and used in place of wooden forms. The tubular parts contain all of the primary reinforcement, so there is little to do at the site of the building but to hoist them into place and pour in fresh concrete.

WIRE ROPE.—Hazard Mfg. Co., Wilkes-Barre, Pa., and 71 W. Adams St., Chicago. Paper; 6 × 9 ins.; pp. 96; illustrated.

This is a decriptive catalog and price list of wire rope of different kinds and for a variety of classes of work. The illustrations show the sections and lay of the several ropes, and the book contains a large number of half-tone engravings showing plants and machinery using the company's rope for hoisting, transmission, cableways, cable inclines, suspension bridges, ship's rigging, derricks and dredges, mine hoisting and haulage, etc. Among the specialties are flat ropes, up to 8 ins. in width. Sheaves, blocks, haulage grips, clamps, shackles and other attachments and appliances, are also included. Information is given as to the working loads, and the use and care of wire rope.

TRACKLAYING MACHINES.—Geo. F. H. Hicks, 315 Wabash Ave., Chicago. Two pamphlets. Paper; 8½ × 11 ins.; pp. 6 and 4; illustrated.

The larger pamphlet describes briefly the improved Harris tracklaying machine. Several views show the different parts of the equipment and the work of tracklaying in progress. There is a long list of railways which have used these machines, and it is stated that twelve railway systems have laid 7,250 miles of track with them. The smaller pamphlet describes and illustrates a rail-handling device to reduce the number of men in the tracklaying gang. The rail is held by tongs on chains attached to two trolley hoists which run out on a boom in advance of the tracklaying machine. The hoists are controlled by levers and lower the rails on the ties as required. This is especially advantageous where labor is scarce or where heavy rails are laid.

ELECTRIC-POWER APPARATUS. — The General Electric Co., Schenectady, N. Y. Bulletins. Paper; 8 × 10½ ins.; illustrated.

Bulletin 4608 in seven pages describes the construction and gives the dimensions of a line of transformers for underground conduit lines and known as the "Type H."

Devices for the automatic control of induction motors are described in Bulletin No. 4590. The automatic compensators described in this bulletin are designed for the remote or automatic operation of motors in sizes of 5 HP. and larger. They consist of two main oils immersed switches operated by solenoids, which are excited from one phase of the current supply. With the closing of the exciting circuit of the solenoids one of the main switches automatically connects the motor to the line through the compensator coils, and an adjustable time relay opens first main switch at the proper time, cutting the compensator coils out of circuit and closing the second main switch, thus throwing the motor directly on the line.

The same publication describes an automatic control equipment for use in maintaining a predetermined air pressure, water pressure or water level, by automatically starting and stopping three-phase motor-driven pumps in the supply mains.

CONCRETE MIXING MACHINES.—Municipal Engineering & Contracting Co., Chicago, Ill. Paper; 9 × 6 ins.; pp. 63; illustrated.

The Chicago improved cube concrete mixer is described at some length, with particular regard to its special features and the advantages claimed for it in comparison with machines of other types. Several forms of the machine are shown, for stationary and portable use, and some of these are equipped with power-operated charging hoppers and concrete buckets. Reference is made to works on which the Chicago machines have been used. The pamphlet contains information as to the proportioning of concrete; the weight of cement; the quantities of cement to a cubic yard of mortar, the voids in gravel, sand and stone, and other relative to the use and preparation of concrete.

POWER STATION APPARATUS.—General Electric Co., Schenectady, N. Y. Bulletins 4,575, 4,585, 4,597. Paper; 8 × 10½ ins.; pp. 10, 8 and 12; illustrated.

Bulletin 4,575 describes an oil-break switch for use where special protection from fire is necessary and is suitable for use in cotton, flour, powder, or saw mills, or for electric installations in connection with oil pumping and refining plants. This "Type F, Form K-7" oil switch has been designed to meet the requirements of induction-motor installations, but may be used wherever a compact, reliable and inexpensive switch is desired.

Aluminum electrolytic lightning arresters are manufactured by this company for all voltages up to 100,000 volts and are designed to protect electrical systems from lightning disturbances and line surges, etc.

Bulletin No. 4,595 describes the Form I arrester. The arrester consists of a "stack" of concentric inverted aluminum cones, insulated from each other and placed in a tank of oil. Before being placed in the oil the space between the cones is partially filled with a special electrolyte. The critical value at which the electrolyte breaks down is 420 volts for any two adjacent cones, and when this potential is reached the action is similar to that of a safety valve and a large amount of current allowed to flow during discharge. This action is produced by a thin film which forms on the aluminum plates by electrolytic action, and as soon as the discharge ceases the film immediately reforms. Illustrations of lightning arresters for different capacities, diagrams of dimensions and connections, and other data are given in the bulletin.

The last bulletin is on Thomson astatic instruments for continuous-current switchboards. These instruments are extensively used, and have a reputation for reliability and accuracy regardless of external influence. They have no controlling springs, and their accuracy is not affected by changes in magnet strength. The damping effect in these instruments is produced by an aluminum disk moving in a magnet field, and the indications are dead beat. The bulletin describes voltmeters and ammeters of the feeder board and illuminated dial types, and gives complete dimension diagrams.

ELECTRIC LIGHTING APPARATUS.—General Electric Co., Schenectady, N. Y. Bulletins 4,594, 4,586, 4,603 and 4,596. Paper; 8 × 10½ ins.; pp. 4, each; illustrated.

The first bulletin listed describes a new illuminating device known as the "Tungsten Economy Diffuser." It consists of a broad reflector surrounding a frosted globe containing the lamps. They are made for five or six lamps and can be adjusted for tungsten tantalum or carbon filament incandescent lamps in all the usual sizes. A special snap switch has been developed which allows different combinations of the lamps to be made with convenience. The bulletin contains photometric curves showing the light distribution under different combinations, the connections and data as to the different styles manufactured.

The second bulletin describes a type of flame arc lamp having some novel features and a simple construction.

In the third bulletin is described an arc lamp specially suited to the illumination of mills and factories, where the vibration caused by machinery, and the variation in line voltage resulting from the use of motors for machine drive render the ordinary arc lamp unsatisfactory. The lamp described is of the multiple type and is for use on 220-volt direct-current circuit. In the design of this lamp special attention has been paid to the insulation of the binding posts and the hanger in order to render practically impossible the grounding of the lamp as a result of the accumulation of dust on the top.

Bulletin 4,596 describes heat-resisting inner globes and gives dimensions of all standard sizes of these, called "Noblac" globes. The ideal enclosing globe retains its original transparency and successfully withstands extremely high temperatures and sudden changes of temperature. Experience has shown that the blackening of inner globes is due principally to two causes: First, the decomposition of ordinary glass due to heat and chemical action; second, the inner surface of the globe, softened by heat, catches particles of unconsumed carbon projected from the arc which become firmly imbedded in the glass. Glass intended to withstand hard usage ordinarily contains a large percentage of lead, which, however, makes the glass soften when heated. The secret of successful manufacture of glass for inner globes consists in the substitution of other ingredients for the lead in order to secure great mechanical strength, and at the same time a high fusing point.

SIGNAL RELAYS.—The Hall Signal Co., New York and Chicago. Paper; 5¼ × 8¼ ins.; pp. 20; illustrated.

This is an illustrated price-list of various types of relay apparatus for signal systems and interlocking plants.

METAL LATH.—Northwestern Expanded Metal Co., 930-950 Old Colony Bldg., Chicago, Ill. Paper; 3¼ × 6 ins.; pp. 12; illustrated.

The methods of applying and plastering "Kno-burn" metal lath are described in this booklet. Several tables of value to users of this lath are included.

INDUSTRIAL LOCOMOTIVES.—The Jeffrey Mfg. Co., Columbus, O. Bulletin No. 13. Paper; 8 × 10 ins.; pp. 32; illustrated.

The uses and advantages of Jeffrey electric locomotives are suggested in this bulletin. Trolley and storage battery locomotives are discussed and shown by illustrations.

CREOSOTED WOOD BLOCK.—The Wyckoff Pipe & Creosoting Co., Stamford, Conn. Paper; 9 × 6 ins.; pp. 16.

This pamphlet emphasizes the advantages of uniformity of size in wood paving blocks and explains how this desideratum is secured for the Wyckoff block. The general points of superiority of creosoted block pavement are briefly set forth.

BOILER COMPOUNDS.—The Bird-Archer Co., 90 West St., New York. Paper; 6 × 9 ins.; pp. 47; illustrated.

This company prepares for each case submitted a special compound based upon an analysis of a sample of feed water. This booklet, which is much more carefully written than many trade publications, discusses the conditions giving rise to formation of scale, oil and grease and corrosion in boilers, and the various means of preventing these evils.

AIR COMPRESSORS AND PNEUMATIC TOOLS.—Ingersoll-Rand Co., New York. Catalog No. EE 36. Paper; 6 × 9 ins.; pp. 49; illustrated. Leaflets 21 A; 36 A; 47 A; 74 B. Paper; 3 × 6 ins.; illustrated.

In these publications are set forth the general features and advantages of Ingersoll-Rand compressors, rock excavating machinery, electric air drills and pneumatic pumping systems. Belt driven and direct connected air compressors are shown in many sizes. The relative merits of the air lift, return air system and pneumatic displacement pump are discussed.

PULVERIZERS AND MIXERS.—Abbé Engineering Co., 220 Broadway, New York. Catalog No. 4 and pamphlet. Paper; 6 × 9 ins.; pp. 62; illustrated.

Pebble mills for the reduction of all hard and soft materials to an impalpable powder are illustrated and described in the catalog. The mills shown range in capacity from 1½ to 4,000 lbs., taking sand as a unit. The pamphlet contains, besides the illustrations, tables of dimensions and prices of machines for sifting and mixing powdered materials in any desired proportions.

CONVEYING MACHINERY.—The Jeffrey Mfg. Co. Booklet No. 57 D. and Folder No. 67 C. Paper; 3½ × 6 and 8 × 10½ ins.; pp. 28 and 6; illustrated.

The booklet contains illustrations showing applications of appliances for handling boxes, barrels, logs, lumber, refuse, etc. In the folder are illustrations and brief descriptive notes of installations of rubber belt conveyors.

DITCHING AND TILE LAYING MACHINE. —St. Paul Ditcher & Carrier Co., Como Ave. and Claghorn St., St. Paul, Minn. Paper; 9 × 12 ins.; pp. 8; illustrated.

This machine has a chain excavator, the rear of which is a chute for laying the tile in place in the trench as the machine advances. A shield between the excavator and chute prevents the sides from caving in before the tile is laid. The machine is self-propelling and is equipped with a 20-HP. gasoline engine.

AUTOMATIC TRAIN CONTROL.—The Kinsman Block System Co., Hudson Terminal Bldg., 50 Church St., New York, N. Y. Paper; 4¼ × 8¾ ins.; pp. 8; illustrated.

The Kinsman system of automatically applying brakes on a train or motor car which passes a "stop" signal, is in use on underground lines at New York and on the Boston elevated railway. The devices for steam and electric railways are described, and also recording device which shows when the apparatus is operated. This makes it possible to tell what train and what engineman is responsible.

COAL WASHING PLANTS AND TIPPLES. —The Jeffrey Mfg. Co., Columbus, Ohio. Bulletins Nos. 22 and 27. Paper; 6 × 9 ins.; pp. 48 and 30; illustrated.

Bulletin No. 22 presents illustrations and brief descriptions of coal tipples and shaking screens. It is made up, mainly, of photographic views and clear elevation drawings of recent installations showing a variety of tipple arrangements.

Bulletin 27 deals with washing plants for the reduction of ash or sulphur in coals. Photographic and sectional views of various types of coal jigs and of complete coal washeries are shown.

For other Proposal Advertisements see pages 43, 44, 46, 49, 50, of Advertisements and Construction News page 148.

GRAVEL ROAD.

Cape May Co., N. J.

Sealed proposals will be received by the Board of Chosen Freenholders of Cape May County, N. J., until twelve o'clock noon of the day of its meeting on the Fourth (4) day of November, nineteen hundred and eight (1908), at Cape May Court House, N. J., for the construction of a gravel road from the northeast end of the bridge over Cape Island Creek at Schellengers Landing, to the center line of the Main Sea Shore Road at Cold Spring, a distance of two and ninety-four thousandths (2.094) miles, and known as the Schellengers Landing Road.

Said road to be constructed according to plans and specifications which may be seen at the office of Hon. Frederick Gilkyson, State Commissioner of Public Roads, Trenton, N. J.; at the residence of A. B. Smith, Director, Beesleys Point; J. P. Fox, Ocean City; Charles Clouting, Sea Isle City; J. D. Ludlam, South Dennis; Daniel Schellenger, Cold Spring; and Henry S. Rutherford, Cape May City, or at the office of the Engineer at Ocean City, N. J.

On the day and date first mentioned all proposals received for said work will be immediately opened and publicly read by the Board of Chosen Freenholders of Cape May County, N. J., the said Board reserving the right to reject any or all bids.

Each bid must be accompanied by a certified check to the amount of One Thousand Dollars ($1,000.00), drawn payable to the order of Anthony B. Smith, Director of the Board of Chosen Freeholders of Cape May County, N. J. The successful bidder will be required to execute within ten days after the contract has been awarded to him a bond in such sum and with such security as shall be approved by the Board of Chosen Freeholders; said bond shall be in a sum not less than the estimated cost of the road when completed.

Each bidder will be required to submit to the State Commissioner of Public Roads, Hon. Frederick Gilkyson, Trenton, N. J., and to the Engineer, prior to the time of submitting bid for constructing, a sample of the gravel he proposes to use in the construction of the road.

All proposals must be on the regular "proposal" form provided for the purpose; sealed and plainly marked on the outside of envelope enclosing them "Proposal for Schellengers Landing Road."

By order of Board of Freeholders.

ANTHONY B. SMITH,
Director.

R. FENDALL SMITH,
County Engineer.

SETTLING BASIN.

Kansas City, Mo.

Sealed bids will be received by the Board of Fire and Water Commissioners at the office of said Board at the City Hall, Kansas City, Missouri, until two o'clock on Monday, November 9th, 1908, for the construction of a settling basin adjoining the present settling basins at Quindaro, Kansas, of either 45 million or 50 million gallons capacity, depending upon the type of construction finally decided on.

A wholly independent proposal is requested upon each of two types of construction, one type embracing earthen embankments capped with a light wash wall, the other type embracing an earthen embankment faced with a reinforced concrete retaining wall with counterforts.

All proposals shall be based upon and shall be in accordance with the approximate estimate of quantities and the plans and specifications approved by the Board of Fire and Water Commissioners and on file in the office of said Board.

Each bid must be accompanied by cash or a certified check in the amount of Two Thousand ($2,000.00) Dollars. Said cash or check to be deposited with and made payable to the City Comptroller of Kansas City, Missouri, as a guarantee that the bidder receiving the award will within ten (10) days from the date of said award, enter into contract and furnish security satisfactory to the City Comptroller that the work named in said bid will be satisfactorily completed.

The Board of Fire and Water Commissioners does not bind itself to accept the lowest or any bid offered, and reserves the right to reject any or all bids when it appears to be to the interest of Kansas City so to do, and further reserves the right to accept a bid on either of the two types of construction upon which proposals are requested.

WATER-WORKS EXTENSIONS AND IMPROVEMENTS.

Gadsden, Ala.

For the above mentioned work sealed proposals will be received by the City Council of Gadsden, Ala., until 12 o'clock noon, Nov. 12, 1908, when they will be opened and publicly read. Drawings and specifications may be consulted and blank forms of proposal obtained at the office of the City Clerk, Gadsden, or at that of the Consulting Engineers, Atlanta, and to whom requests for additional information should be addressed. Each proposal must be accompanied by a certified check in the sum of one thousand ($1,000) dollars, payable to the City Treasurer, and the Contractor to whom the award is made will be required to furnish a surety company bond in the sum of ten thousand ($10,000) dollars for the faithful performance of the contract.

The usual rights reserved.

J. D. DUNLAP, Mayor,
Gadsden, Ala.

HAZLEHURST & ANDERSON,
Engineers,
Candler Building, Atlanta, Georgia.

NEW PLUMBING AND CONSTRUCTION.—Fort Hancock, N. J., October 19, 1908.—Sealed proposals for new plumbing and construction in barracks 22, 23, 24 and 25 at this post will be received at this office until 3 P. M., November 18, 1908, and then opened. Information furnished on application. U. S. reserves right to reject any or all proposals. Bidders who are not manufacturers of the fixtures and material they propose to install, will submit the name of the manufacturer with their bid. Envelopes containing proposals should be indorsed "Proposals for new plumbing and construction," addressed W. J. HAWKINS, Constructing Quartermaster, U. S. Army.

SEWERAGE SYSTEM.

Village of Haverstraw, N. Y.

Sealed proposals for building a sewer system for the Village of Haverstraw, N. Y., in accordance with the contract and specifications to be furnished by the Board of Trustees, will be received at the Village Hall at 7:30 P. M. on November 4th, 1908, and at that time and place will be publicly opened and read.

The work includes the following approximate quantities:

2,470 ft. of 36-inch brick or combination concrete and brick sewer.
1,170 ft. of 30-inch brick or combination concrete and brick sewer.
970 ft. of 18-inch double strength vitrified pipe sewer.
2,332 ft. of 15-inch double strength vitrified pipe sewer.
1,832 ft. of 12-inch double strength vitrified pipe sewer.
4,890 ft. of 10-inch double strength vitrified pipe sewer.
37,375 ft. of 8-inch double strength vitrified pipe sewer.
240 ft. of 30-inch cast-iron pipe sewer.
120 ft. of 16-inch cast-iron pipe sewer.
36 ft. of 10-inch cast-iron pipe sewer.
84 ft. of 8-inch cast-iron pipe sewer.
119 manholes.
47 flush tanks.
1,200 ft. submerged 14" cast-iron pipe.

Proposals must be accompanied by a certified check for $5,000.00.

Plans and specifications can be seen at the office of the Village Clerk, and at the office of Alexander Potter, Consulting Engineer, 143 Liberty St., New York City.

The right is reserved to reject any or all bids.

By order of the Board of Trustees.

THOMAS LYNCH,
President.

HENRY F. DORL,
Clerk.

ALEXANDER POTTER,
Chief Engineer.

CONCRETE WHARF.

Detroit, Mich.

Sealed proposals will be received at the office of the Public Lighting Commission, No. 40 Atwater Street East, Detroit, Mich., until Monday, November 2d, at 4:00 o'clock p. m., for constructing a concrete wharf on the premises of the Commission in the rear of the power-house, in accordance with plans and specifications on file in the office of the Commission.

By order of the Public Lighting Commission.

F. MISTERSKY,
Genl. Supt.

PROPOSALS FOR THREE RAPID UNLOADING CRANES.—Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10:30 a. m., November 16, 1908, at which time they will be opened in public for furnishing the above-mentioned articles. Blanks and general information relating to this Circular (No. 475) may be obtained from this office or the offices of the Assistant Purchasing Agents, 24 State Street, New York City; Custom-House, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.; also from the U. S. Engineer Offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburg, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Commercial Club, Kansas City, Mo.; Chamber of Commerce, Quincy, Ill., and Chamber of Commerce and Board of Trade, Tacoma, Wash. F. C. BOGGS, Captain, Corps of Engineers, U. S. A., General Purchasing Officer.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., October 7, 1908.—Sealed proposals will be received at this office until 3 o'clock P. M. on the 3d day of November, 1908, and then opened, for improvements to buildings, etc., at the U. S. Quarantine Station, Brunswick, Ga., in accordance with specifications, copies of which may be had at the discretion of the Supervising Architect, by applying at this office or to the office of the Medical Officer in Command, Brunswick, Georgia. JAMES KNOX TAYLOR, Supervising Architect.

U. S. ENGINEER OFFICE, Galveston, Texas, Oct. 14, 1908.—Sealed proposals, in duplicate, for dredging in Buffalo Bayou, Tex., will be received here until 12 noon, Nov. 14, 1908, and then publicly opened. Information on application. JOHN C. OAKES, Capt., Engrs.

TREASURY DEPARTMENT, Office of the Supervising Architect, Washington, D. C., October 12, 190[illegible].—Sealed proposals will be received in [illegible] office until 3 o'clock P. M. on the 2[illegible] day of November, 1908, and then opened, for the construction (complete) of the U. S. Post Office at Baker City, Oregon, in accordance with the drawings and specifications, copies of which may be had at this office, or at the office of the Postmaster at Baker City, Oregon, at the discretion of the Supervising Architect. JAMES KNOX TAYLOR, Supervising Architect.

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